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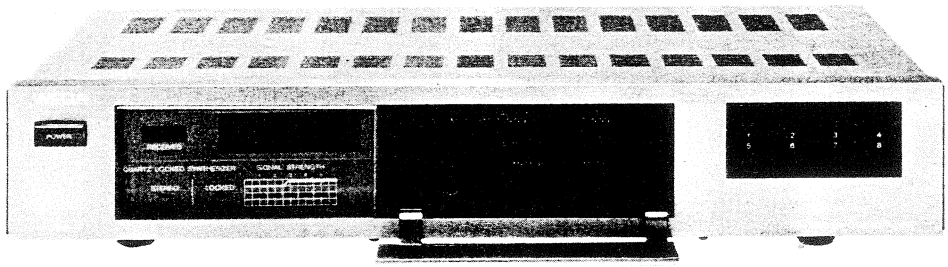
WEGA FM/MW/LW 3BAND TUNER T555

Service Manual 8/81



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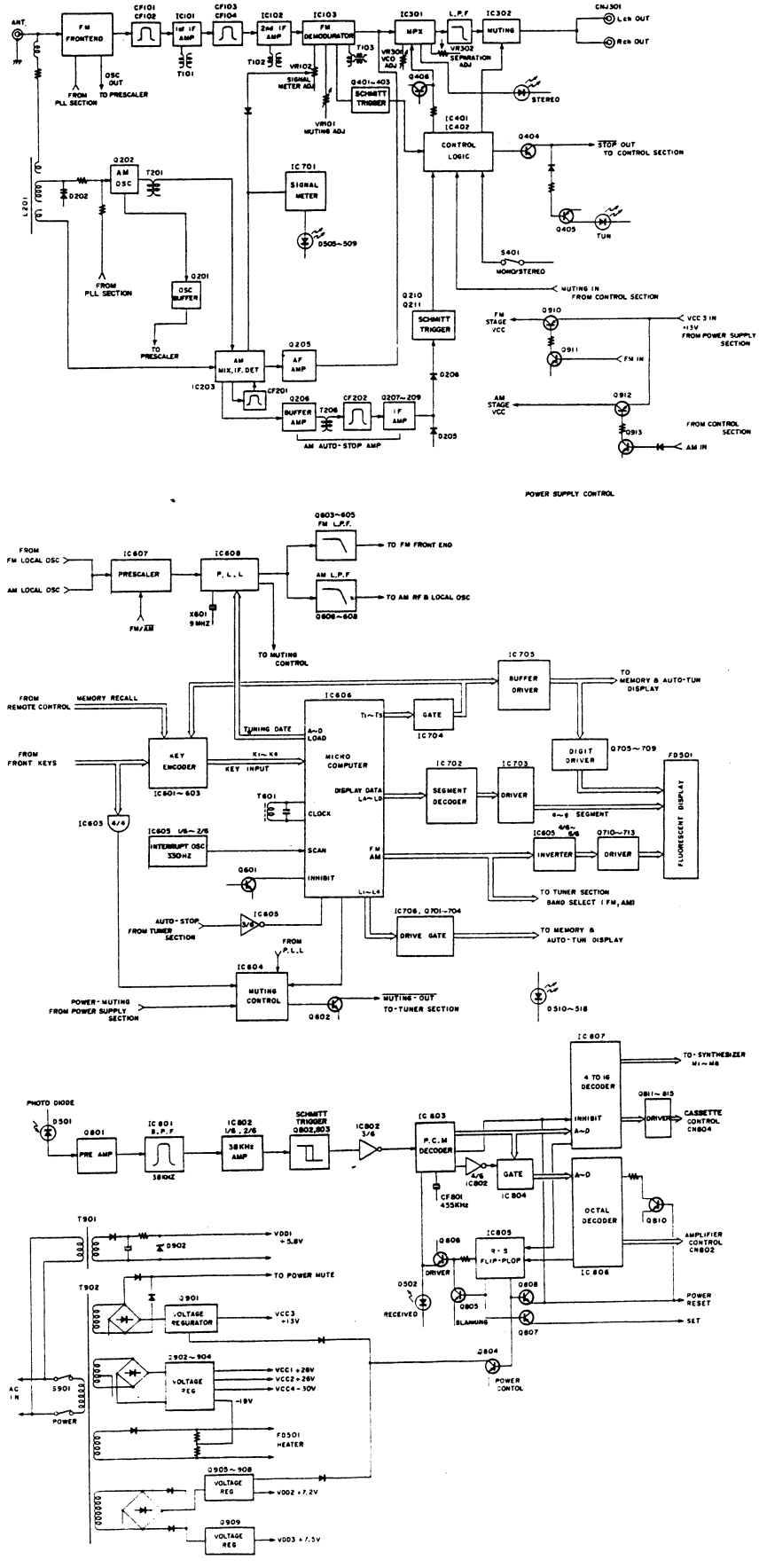
SPECIFICATIONS

Tuning Range	FM	87.5–108 MHz
	MW	522–1611 kHz
	LW	137–372 kHz
Antenna	FM	75 Ω
	MW, LW	Ferrite Bar Antenna
Sensitivity	FM	Mono 1.3 µV (S/N = 26 dB 40 kHz Hub)
	FM	Stereo 49 µV (S/N = 46 dB, 40 kHz mod.)
(S/N = 20 dB)	MW	320 µV/m
(S/N = 20 dB)	LW	1 mV/m
Signal to Noise Ratio DIN	FM	Mono 68 dB
	FM	Stereo 60 dB
	MW	51 dB (50 mV/m)
	LW	51 dB (50 mV/m)
Distortion	FM	Mono 0.1 %
	FM	Stereo 0.35 %
	MW	0.5 %
	LW	0.8 %
Stereo Separation (1 kHz)	FM	47 dB
Power Requirement		220 V/50 Hz
Power Consumption		15 W
Dimensions (W x H x D)		430 x 80 x 307 mm
Weight		4.5 kg

SECTION 1
OUT LINE

Block Diagram

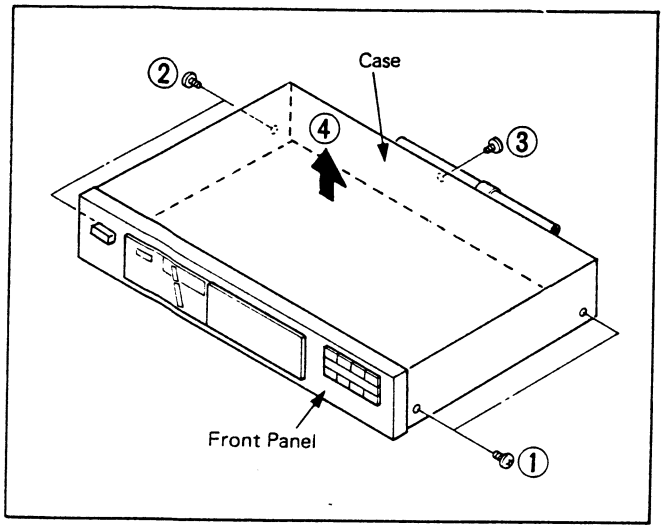


SECTION 2
DISASSEMBLY

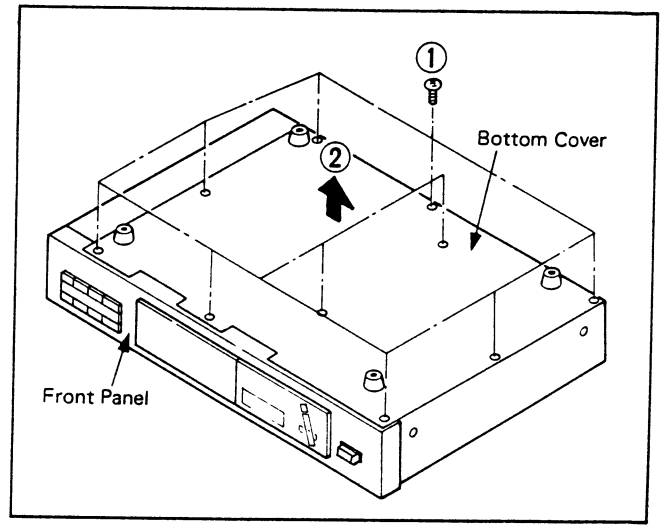
Removal

Follow the disassembly procedure in the numerical order given.

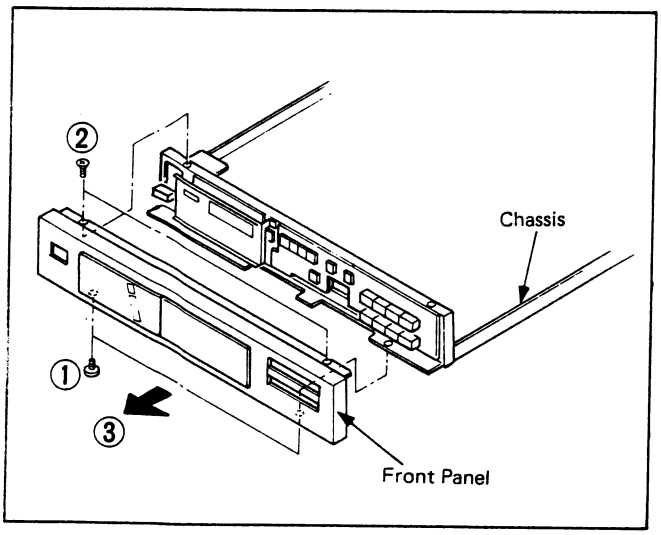
a. Case Removal



b. Bottom Cover Removal



c. Front Panel Removal



d. Door (Front Panel) Removal

1. Remove 4 screws in *Fig. 1.*

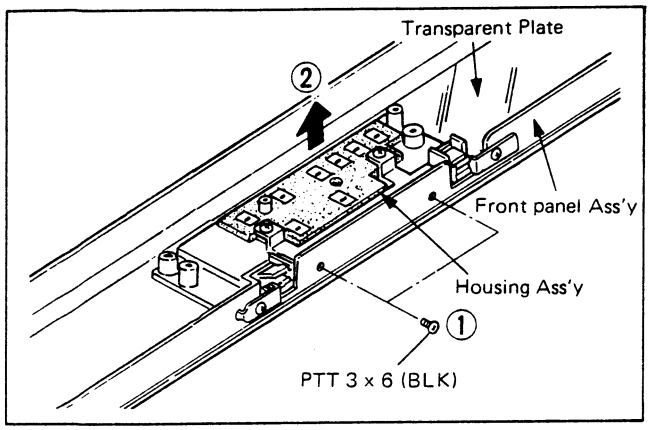


Fig. 1

2. Remove 2 screws PTT 3 x 6 and pull out Front Panel Door as shown in *Fig. 2.*

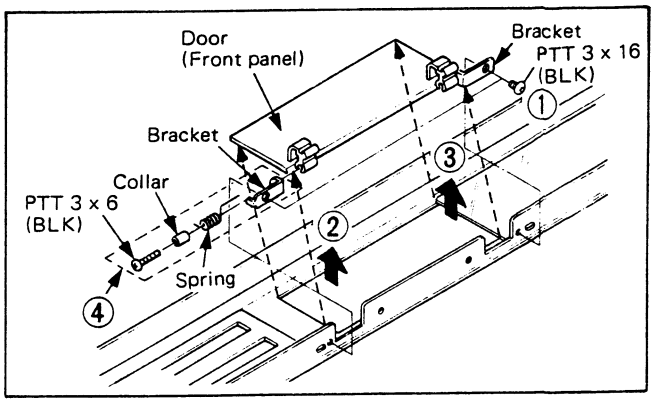


Fig. 2

SECTION 3
ELECTRICAL ADJUSTMENT

A. FM/AM TUNER ALIGNMENT PROCEDURS

AM SECTION

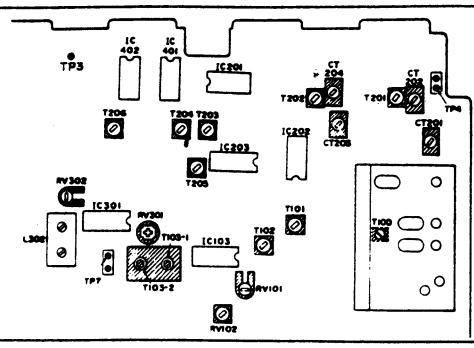
Step	Alignment & Conditions	Alignment Procedures	Adjust
1.	LW Band Tuning Range Function: LW	a. Connect digital Voltmeter between TP4 and ground. b. Adjust tuner to obtain frequency readout of 137kHz. c. Adjust T202 to obtain 1.600V ±0.05V on voltmeter. d. Adjust tuner to obtain frequency readout of 362kHz. e. Adjust CT204 to obtain 22.20V ±0.1V. f. Repeat steps (b)—(e) until no further improvement is obtained.	T202 for 1.600±0.1V CT204 for 22.20±0.1V
2.	MW Band Tuning Range Function: MW	a. Connect digital voltmeter between TP4 & ground. b. Adjust tuner to obtain frequency readout of 522kHz c. Adjust T201 to obtain 1.400 ±0.05V on the meter. d. Adjust tuner to obtain frequency readout of 1611kHz. e. Adjust CT202 to obtain 22.20 ±0.1V. f. Repeat steps (b)—(e) until no further improvement is obtained.	T201 for 1.400±0.05V CT202 for 22.20±0.1V
3.	AM IF Alignment Function: MW or LW SG Freq.: 450.00kHz * Keep antenna input level as low as required.	a. Connect VTVM to TUNER OUT jack. b. Feed exact 450.00kHz signal to tuner ant. through radiation loop. c. Adjust T203, T204, T205 for max. audio output on VTVM. d. Adjust T206 for MAX. DC LEVEL of TP3.	T203, T204, T205 & for max. output
4.	LW Tracking Alignment Function: LW SG: 1kHz, 30% mod. * Keep generator output as low as required.	a. Adjust SG to 155.00kHz and tune in tuner to the same frequency. b. Adjust SG to 344kHz and tune in tuner to the same frequency. c. Repeat steps above until no further improvement is obtained.	L201-1 for max. audio output. CT203 for max. audio output.
5.	MW Tracking Alignment Function: MW SG: 1kHz, 30% mod. * Keep generator output as low as required.	a. Adjust SG 603kHz and tune in tuner to the same frequency. b. Adjust SG to 1404.00kHz exactly and tune in the tuner to the same frequency. c. Repeat above steps until no further improvement is obtained.	L201-2 for max. audio output. CT201 for max. audio output.

FM SECTION

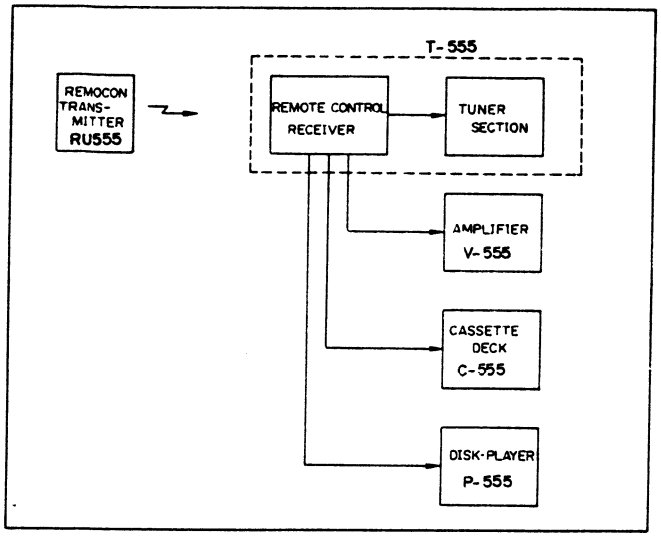
Step	Alignment & Conditions	Alignment Procedures	Adjust
1.	FM IF Alignment Function: FM FM SG: 98.00MHz, 1kHz 75kHz dev.	a. Connect audio analyzer to tuner output jack(s) and center meter to TP1 and TP2. b. Adjust T100, T101, & T102 for max. noise output (SG Output: zero). c. Adjust T103-1 (org.) for exact center reading on center meter. d. Adjust SG to provide 65dBf antenna input and tune in tuner to the 98.00MHz. e. Adjust T100, T101, T102 & T103-2 (blk) for minimum distortion.	T100, T101 & T102 for max. noise output. T103-1 for exact center. T100, T101, T102 & T103-2 (blk) for minimum distortion.
	(Muting Bandwidth) STEREO-MONO SW: STEREO	f. Place Stereo-Mono SW in stereo position. g. Slowly tune off SG freq. from 98.00MHz and measure both up- and down-ward muting band widths. The bandwidth difference should be within 1kHz. If not, adjust T103-1 (ignore center meter indication). h. Adjust T103-2 again for minimum distortion. i. Check muting bandwidth again. If bandwidth difference is still higher than 1kHz, repeat steps (g) and (h).	T103-1 for equal muting frequency bandwidth. T103-2 for minimum distortion.

Step	Alignment & Conditions	Alignment Procedures	Adjust
2.	FM Front End All alignments have been fixed at the factory, and no alignment is necessary.		
3.	FM Muting Sensitivity Function: FM Stereo-Mono SW: Stereo FM SG: 98.00MHz 1kHz, 75kHz dev. 23dBf Antenna Input	a. Tune in tune to 98.00MHz. b. Temporarily turn RV101 counter clockwise fully, then turn RV101 clockwise until audio output just disappears.	RV101 for muting threshold level.
4.	VCO Alignment Function: FM Stereo-Mono SW: Stereo FM SG: 98.00MHz 65dBf antenna input no modulation * Two minutes aging should be performed without fail, and this alignment should be finished within 2 minutes and 30 seconds.	a. Connect frequency counter to TP6 and TP7 (GND). b. Tune in tuner to 98.00MHz and allow the tuner for 2 minutes aging. c. Adjust VR301 for 75.950kHz ±50Hz.	VR301 for 75.950kHz±50Hz
5.	FM Stereo Separation Function: FM Stereo-Mono SW: Stereo SG: 98.00 MHz, Mod. 1kHz L-CH dev.: 45% (33.75kHz) R-CH dev.: 45% (33.75kHz) Pilot: 10% (7.50kHz) 65dBf Ant. Input	a. Modulate FM SG with L-CH stereo signal. b. Adjust RV302 for min. right channel noise output. c. Modulate FM SG with R-CH stereo signal. d. Check left channel noise output (leakage from right channel), it should be the same as that obtained in step (b) above. If not, repeat steps (a) through (d) to obtain equal and maximum separation.	RV302 for min. noise output (leakage signal from left channel). RV302 for equal and max. separation.
6.	Meter Alignment Function: FM Stereo-Mono SW: Mono SG: 98.00MHz 100dBf Ant. Input	a. Tune in tuner to 98.00MHz. b. Adjust RV102 so that fifth LED segment of meter just lights up.	RV102 to just turn on fifth LED segment.

Adjustment Location



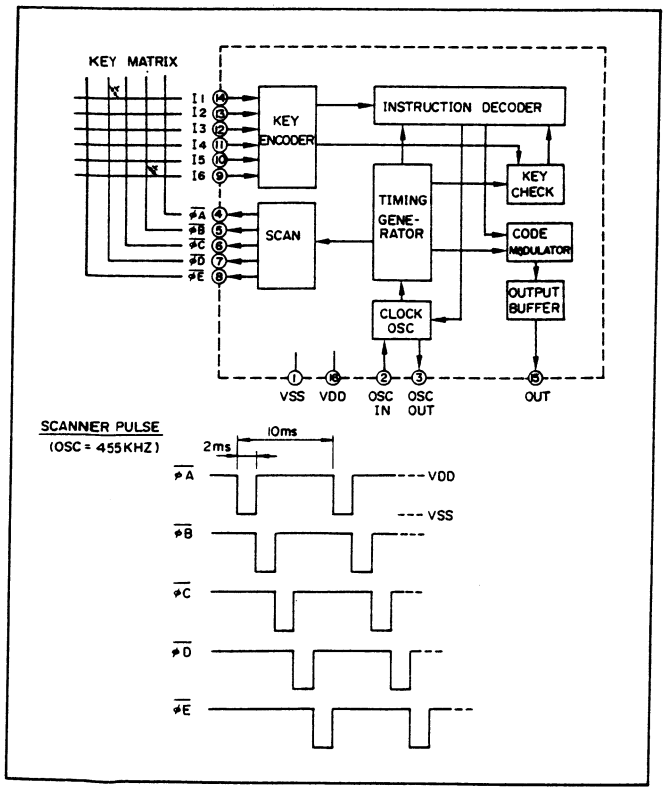
B. ON REMOTE CONTROL SYSTEM



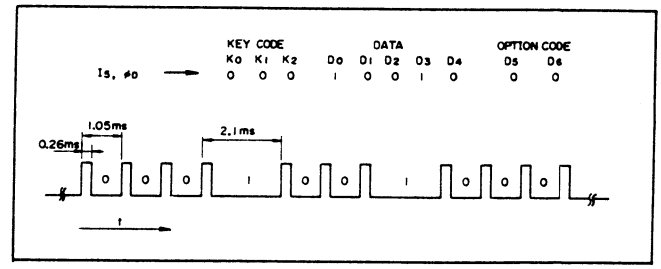
The remote control system has been designed to be controlled by the remote control unit, RU555, so operation theory of RU555 will be given first.

3-1 Operation Theory of RU555

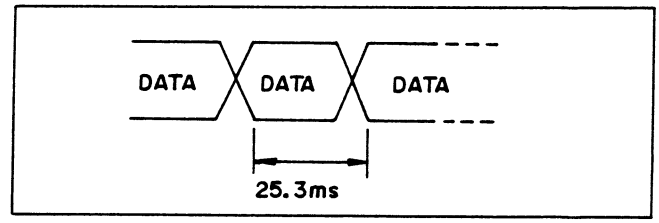
The RU555 is capable of transmitting 30 different commands consisting of 10 bit P.C.M (pulse code modulation) codes, however in the actual unit 23 commands of them are used.
The block diagram of IC M50110P used will be given below.



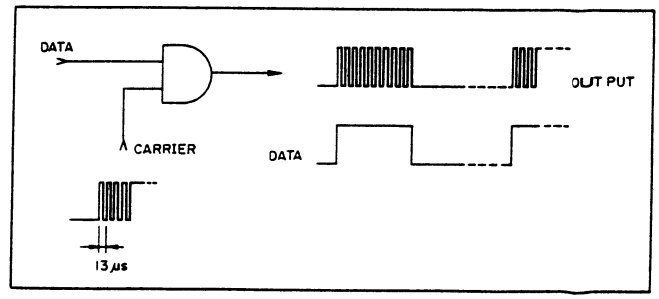
When one of command keys of the RU555 is depressed, the key encoder detects an address corresponding to that key by referring to the timing of scanner pulses and $I_1 \sim I_6$ inputs. The command signals corresponding to the address are then transferred to the instruction decoder. The decoder decodes the command and send it as 10 bit series data code modulation signals with the timing pulses from the timing generator. As an example, when the "TUNER" key (I_5, ϕ_D) is depressed, the data shown below will be developed.



As can be seen from above, one word command is transferred with 10 bits, and the time required to transfer the one word depends upon kind of commands, the maximum of which is 14.7ms. When the key is being depressed, the same data is transferred repeatedly with a timing interval of 25.3 ms.
In case where two or more keys are depressed at the same time, a key check circuit detects the state and stops data transmissions.



Finally, 38kHz carrier is modulated (sampled) with the code modulation signals, and the resultant outputs are final data.



The final data are applied to Q1 (2sD400F) driver to drive the infrared emitting diode which converts the data into infrared beams and transmits the data on air.

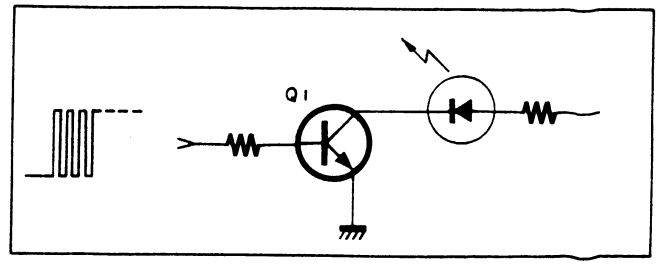
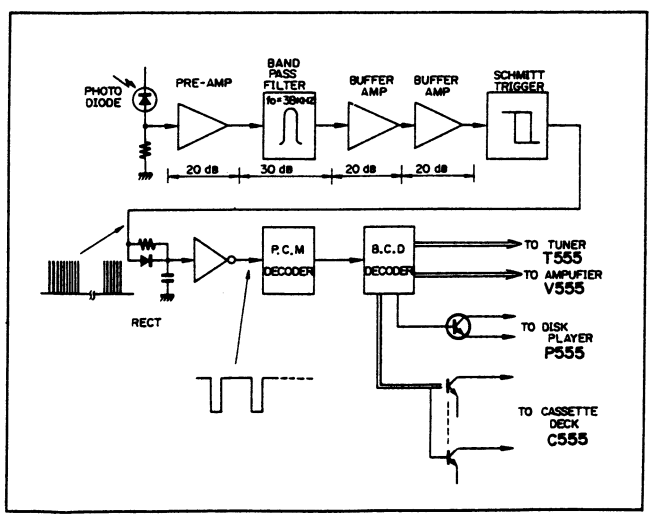


TABLE OF COMMANDS AND OUTPUT DATA USED IN RU555

COMMANDS	DATA									
	K_0	K_1	K_2	D_0	D_1	D_2	D_3	D_4	D_5	D_6
POWER OFF	0	0	0	0	0	0	0	1	0	0
MEMORY 3	0	0	0	1	0	0	0	1	0	0
MEMORY 4	0	0	0	0	1	0	0	1	0	0
MEMORY 2	0	0	0	1	1	0	0	1	0	0
MEMORY 1	0	0	0	0	0	1	0	1	0	0
MEMORY 5	0	0	0	1	0	1	0	1	0	0
MEMORY 6	0	0	0	0	1	1	0	1	0	0
MEMORY 7	0	0	0	1	1	1	0	1	0	0
MEMORY 8	0	0	0	0	0	0	1	1	0	0
PLAY	0	0	0	1	0	0	1	1	0	0
PAUSE	0	0	0	0	1	0	1	1	0	0
STOP	0	0	0	1	1	0	1	1	0	0
REW	0	0	0	0	0	1	1	1	0	0
FF	0	0	0	0	1	1	1	1	0	0
START/STOP	0	0	0	1	1	0	0	0	0	0
TAPE	0	0	0	0	1	0	0	0	0	0
AUX	0	0	0	0	0	1	0	0	0	0
VR DOWN	0	0	0	1	0	1	0	0	0	0
VR UP	0	0	0	0	1	1	0	0	0	0
PHONO	0	0	0	1	1	1	0	0	0	0
POWER ON	0	0	0	0	0	0	1	0	0	0
TUNER	0	0	0	1	0	0	1	0	0	0
REC	0	0	0	1	0	1	1	1	0	0

3-2 Operation Theory of Remote Control Receiver

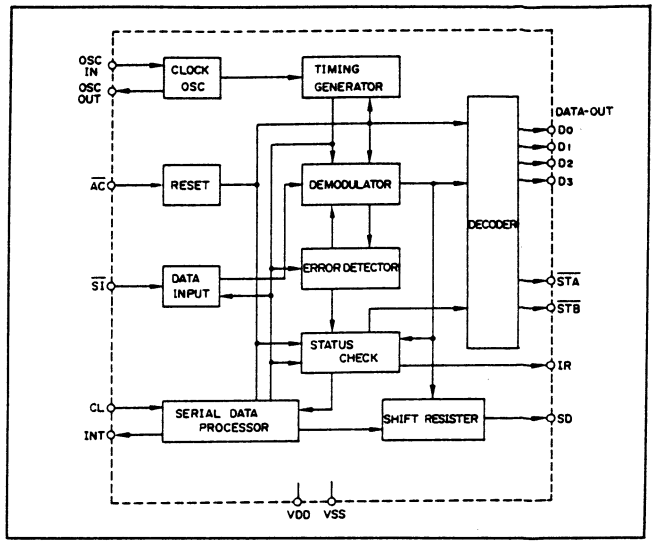
The remote control receiver section has been equipped with the tuner (T555) and its block diagram is shown below.



The linear amplifier section amplifies the PCM signals supplied from the photo diode by approximately 90 dB (31600 times), and the amplified outputs are wave-shaped by a schmitt trigger and rectification circuits. Thus reproduced original data are applied to the PCM decoder in a form of negative logic.

OPERATION OF PCM DECODER IC M50111P

M50111P Block Diagram



When V_{DD} is applied, a reset operation is performed first inside the IC by a capacitor connected to the $\overline{AC}$ input terminal.

Next, when data signals from RU555 are applied to $\overline{SI}$, the data are sent to the demodulator with signals from the timing generator and converted into static data. The static data are then checked with an error detector and a status check circuit whether the data are normal or not, and if normal, the data are sent to the DATA OUT terminal as 4 bit data, at the same time chip select signal is developed at $\overline{STA}$ and $\overline{STB}$ terminals (the data sampling is conducted twice, and the data are sent out only if they are the same in twice sampling.). If abnormal signals (such as noise, signals for another remote control) are observed, the output is inhibited.

When the data are normal, the IR signal level changes from a low level to a high level and makes the RECEIVED indicator light up.

Now relations between transmit data from RU555 and4-bit data & $\overline{STA}$, $\overline{STB}$ are given below:

Transmit Data From RU5

	K_0	K_1	K_2	D_0	D_1	D_2	D_3	D_4	D_5	D_6
e.g TUNER	0	0	0	1	0	0	1	0	0	0
M50111P OUTPUT	No Signal			Signal				Signal Off		
D_0	0	→		1	→			0		
D_1	0	→		0	→			0		
D_2	0	→		0	→			0		
D_3	0	→		1	→			0		
$\overline{STA}$	1	→		0	→			1		
$\overline{STB}$	1	→		1	→			1		
IR	0	→		1	→			0		

Note:

Where 0 = V_{SS} level, 1 = V_{DD} level

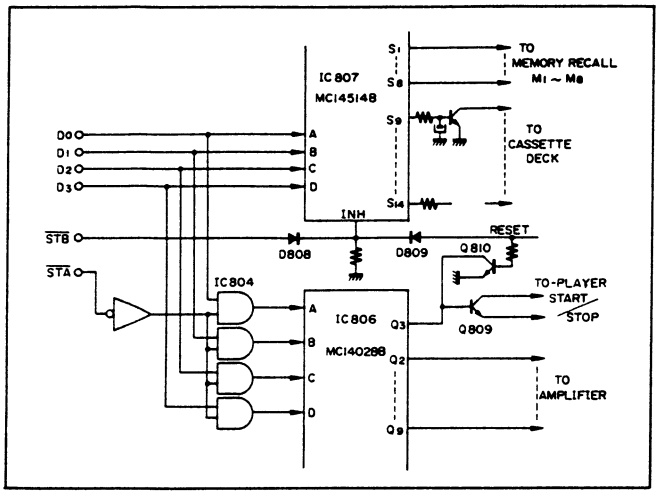
Namely, D0 – D3 of the transmitted data from the RU555 are converted into static data and developed at the D_0–D_3 terminals of M5011P. The D4 of RU555 is corresponding to $\overline{STA}$ and $\overline{STB}$ of M50111P in such a way that if D_4 is "0" "STA" becomes "0", and if D_4 is "1" $\overline{STB}$ becomes "0" ($\overline{STA}$ and $\overline{STB}$ are active low).

The remaining bits, K_0–K_2, and D_5, D_6 are descrimination data, so they are not developed as output signals.

Since the outputs data of M50111P are not latched, they are developed only during the data is being transmitted by the RU555.

BCD DECODER SECTION

This section is to send control signals to other circuits according to the output codes from the PCM decoder.



4-bit data of D_0–D_3 are data to designate each function, and $\overline{STA}$ & $\overline{STB}$ are signals to designate the decoder IC. Therefore, if the $\overline{STA}$ & $\overline{STB}$ are assumed as 1 bit, the data can consist of 5 bits in total, and 32 functions can be controlled. However, in the actual unit 23 of them are used.

Now assume $\overline{STA}$ is "0" and STB is "1", and the gate of IC804 will open and D_0–D_3 data are applied to the IC806. Then the IC806 controls the player and the amplifier. At the same time, "1" level signal of $\overline{STB}$ is applied to the INH (inhibit) terminal of IC807, and all outputs from the IC807 are inhibited (off). The INH terminal of the IC807 is also connected to the reset signal (which becomes "1" level only when the power is turned off with the remote control transmitter) line, and if the reset signal is being applied, the control function for the player and cassette deck are completely disabled. The controls for the cassette deck and the player are performed in negative logics.

Now, the truth table for D_0–D_3 and $\overline{STA}$ & $\overline{STB}$ is shown below. The transistor Q810 is designed to be turned on so that the player can not operate if its operation button is depressed during the unit power is turned off by the remote control unit (RU555).

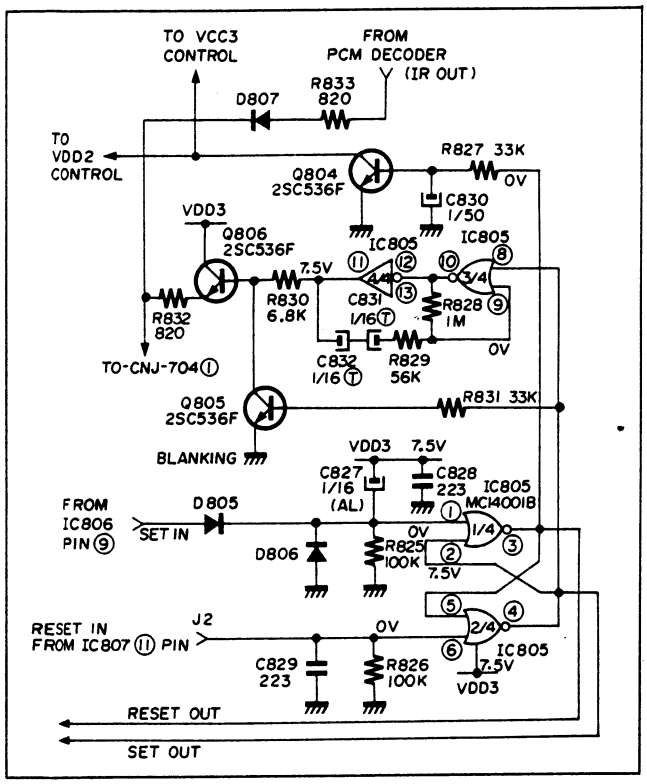
DECODER SECTION TRUTH TABLE

Note: "1" = V_{DD} Level
"0" = V_{SS} Level

FUNCTION	INPUT DATA / OUTPUT	DECODER OUTPUT																												
	Chip Select		DATA				IC807 MC14514B															IC806 MC14028B									
	$\overline{STA}$	$\overline{STB}$	D_0	D_1	D_2	D_3	S_0	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}	S_{13}	S_{14}	S_{15}	Q_0	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_7	Q_8	Q_9
POWER OFF	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEMORY 3	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEMORY 4	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEMORY 2	1	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEMORY 1	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEMORY 5	1	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEMORY 6	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEMORY 7	1	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEMORY 8	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PLAY	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PAUSE	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STOP	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REW	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
FF	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
REC	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
PLAYER START/ STOP	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
TAPE MONI	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
AUX	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
VR DOWN	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
VR UP	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
PHONO	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
POWER ON	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
TUNER	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

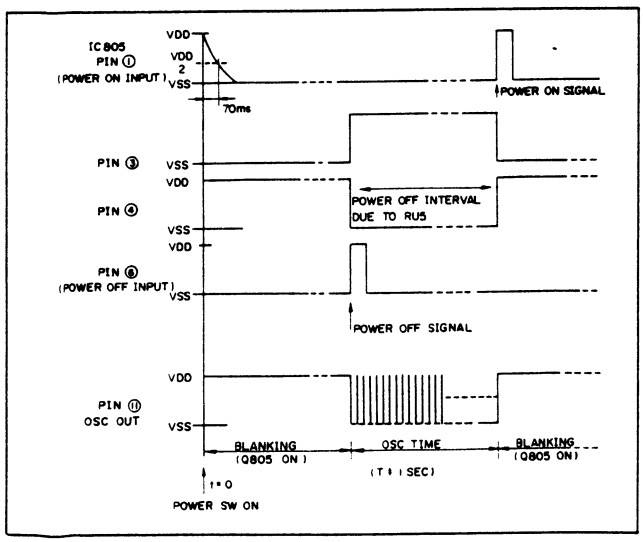
POWER SUPPLY CONTROL

This circuit is to control on/off operation of the main power source, and in actual circuit V_{DD_2} and V_{CC_3} are turned on or off by the remote control unit (RU555). When the power is turned off by the remote operation, the oscillator which is used to flash the "RECEIVED" LED indicator is also actuated.



When the power switch (S-901, 2) is turned on, pin 1 of IC805 is set to "1" level by C827 and R825 for about 70 msec, then pin 3 of IC805 falls to "0" level, and pin 4 is forced to "1" level. Under this condition, if the pin 1 level changes to "0" level after elapse of about 70 msec, the NOR gate output in the R-S flip-flop is not changed, and the pin 3 is held in "0" level and the pin 4 is held in "1" level.

Now, timing charts will be given below.



When pin 4 is in "1" level (power on), pin 10 is in "0" level and pin 11 is in also "1" level, but the base of Q806 is forced to "0" level by Q805, therefore the "RECEIVED" indicator LED can not light up. However, when pin 4 falls to "0" level (power off), the oscillator is actuated by 3/4-4/4 of IC805 and Q805 is turned off, then the LED starts flashing through Q806 with a period of one second.

The flashing period T is determined by following equation.

$$T \doteqdot \frac{1}{2CR}$$

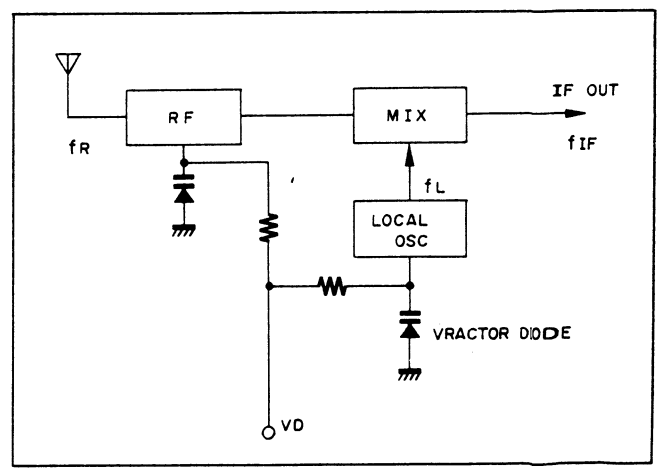
Where C = 0.5 μF ..... C831 and C832

R = 1 M ohm R828

When the power is turned off by the RU555, since pin 3 of IC805 is in "1" level, Q804 is turned on and the collector of Q804 falls to V_{SS} level and the voltage regulator for V_{DD_2} and V_{CC_3} is turned off. A diode D805 is provided so that the set signal caused by C827 and R825 is not absorbed by the IC806 when the switches S901 and S902 are turned on.

Thus obtained RESET OUT signal at pin 3 and the SET OUT signal at pin 4 are used to control the amplifier power supply after they are buffered by transistors Q807 and Q808, respectively.

3-3 Outline of PLL Digital Tuning System



Tuner Front End Section

The block diagram shows a basic tuner front end section.

From the block diagram it may be easily understood that at varying the VD (voltage applied to varactor diodes) will vary the receive frequency. The VD is a DC voltage. In the description which follows a discussion on the varactor diode used in the RF section will be omitted, since the diode is used only to make a tuning frequency follow a local oscillator frequency.

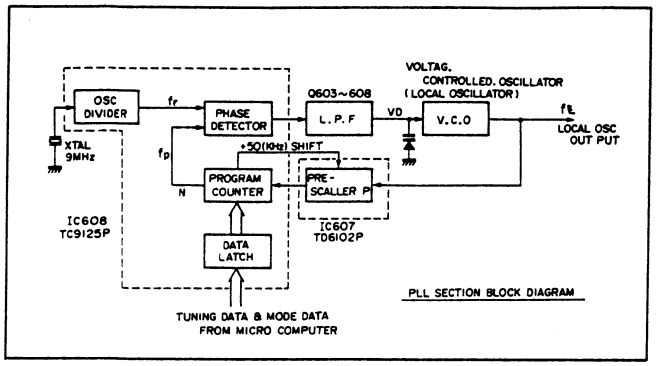
A receive frequency f_R will be given by a following equation.

$$f_R = f_L \pm f_{IF}$$

where f_L: Local oscillator frequency

f_{IF}: IF frequency

Therefore it may also be understand that f_R can be varied with f_L varied, if f_{IF} is kept constant. Namely varying the VD will change f_R. However, varying the VD may require a reference to which a varied local oscillator frequency is compared. To achieve this comparison between the local oscillator f_L and the reference frequency f_r, a PLL (Phase Locked Loop) circuit, which develops the VD to control the receive (local oscillator) frequency, is used.



In the block diagram above, if the frequency dividing ratio of the Prescaller is assumed as P, and that of the Program Counter as N, the f_L will be determined as follows:

The phase lock condition of the loop is:

$$f_P = f_r \quad \ldots\ldots (1)$$

$$f_P = \frac{f_L}{PN + C} \quad \ldots\ldots (2)$$

$$f_L = f_P (PN + C)$$

Where f_r is the reference frequency, f_P is a frequency to be compared, C is a constant for frequency shift and is either "0" or "4".

A receive frequency f_R is (if upper side heterodyned frequency is used):

from the equations (1) and (2)

$$f_R = f_r \times (PN + C) - f_{IF} \quad \ldots\ldots (3)$$

By substituting actual values in a FM reception at 100.00 MHz into the equation (3), N will be determined as follows:

(f_L = 110.7 (MHz))

f_r = 12.5 (kHz)

f_R = 100.00 (MHz)

f_{IF} = 10.7 (MHz)

P = 8

C = 0 (or 4 in case of 50kHz shifting)

$$N = \frac{f_R + f_{IF}}{f_r \times P} = 1107$$

Accordingly, when the dividing ratio of the programmable counter is set to 1107, 100.00 MHz can be received.

The data on the dividing ratio is transferred from the micro-computer IC606 to IC608.

Next, try to calculate N for reception of f_R = 100.05 MHz, in this case "C" in the equation (3) is set as 4, therefore N is:

$$N = \frac{f_R - f_r \times C + f_{IF}}{f_r \times P}$$

$$= \frac{100.05 \times 10^6 - 12.5 \times 10^3 \times 4 + 10.7 \times 10^6}{12.5 \times 10^3 \times 8} = 1107$$

The same dividing ratio as that required for 100.00MHz reception is obtained.

Namely, shifting the frequency by 50kHz upward can be attained by extracting four pulses in the Prescaller circuitry with the N not changed.

This operation is also transferred from microcomputer IC606 to the PLL IC (IC608) as a mode data in addition to the data on dividing ratio. The PLL IC with this instruction received instructs for the Prescaller to extract the pulses.

In the FM band the receive frequency is changed by 100kHz step with N changed by one (1).

In the AM band,

fr = 1 kHz

P = 1

C = 0

f_{IF} = 450 kHz, and

$f_R = f_r \times N - f_{IF}$

For example, N will be obtained as follows for reception of 1200 kHz on the MW band,

(f_L = 1650 kHz)

$$N = \frac{f_R + f_{IF}}{f_r} = 1650$$

For reception of f_R = 1201 kHz, N will be obtained in the similar way as 1651. Namely changing N by one (1) varies receive frequency of 1 kHz. In this way, when the dividing ratio for a receive frequency is determined, operation of feedback in the PLL loop is repeated to control the local oscillator until a desired local oscillator frequency is obtained.

3-4 PLL Frequency Synthesizer Circuit Description

(1) Local Oscillator Frequency Determining Loop

The loop is comprised of IC607 (dividing frequency only in FM mode of operation) to which the local oscillator output frequency is applied, IC608 (PLL system), and Q603–605 & Q606–608 which drive the oscillator with the output DC voltage(s).

(2) IC607 Prescaller

The IC divides the local oscillator frequency and applies the divided frequency to the IC608 (PLL). The dividing ratio of the prescaller is 1/8.

The IC is equipped with 25 kHz and 50 kHz shift circuits and this allows 50 kHz step reception.

FM and AM switching is performed by applying "1" level or "0" level signal to pin 7. For FM reception, "1" level (V_{CC} level) is applied. During AM operation, the IC is used as simple gate circuits.

(3) IC608 P.L.L.

The IC608 is comprised of a programmable counter, phase detector, buffer, reference divider, latch, decoder, etc.

The signal divided by the IC607 is applied to the programmable counter to divide it further. Then the divided signal is led to the phase detector to detect a phase difference relative to the reference frequency which is also applied to the phase detector. The resultant phase difference is applied to the L.P.F. (Low Pass Filter).

The microcomputer IC606 controls the frequency dividing ratio for the programmable counter by supplying its signals to the pins 4–8. Pin 4 is a terminal for LOAD signal, and the data at pins 5–8 are read into the LATCH only during the pin 4 is in "1" level.

The data determines the frequency dividing number of the programmable counter. The data applied to the pin 5 through pin 8 are replaced with new one only when the receive frequency is changed. Accordingly, data at pins 4–8 under normal receive condition are held as "0" level.

• Reference Frequency

9.00MHz frequency is generated by means of a X'tal connected to the pins 2 and 3. And the frequency is counted down with the reference divider to 12.5kHz for FM mode of operation or 1 kHz for AM reception, then it is applied to the phase detector.

• Phase Detector and Buffer

This compares a divided reference frequency with a divided local oscillator frequency in their phases. When the phase of the local oscillator frequency is delayed from that of the reference frequency, the buffer output becomes "0" level for the period of the delayed time period, on the contrary, when the phase of the local oscillator is advanced, the buffer output develops "1" level signal for the advanced time period.

D_{01} (pin 14) . . . . . FM, D_{02} (pin 15) . . . . . AM

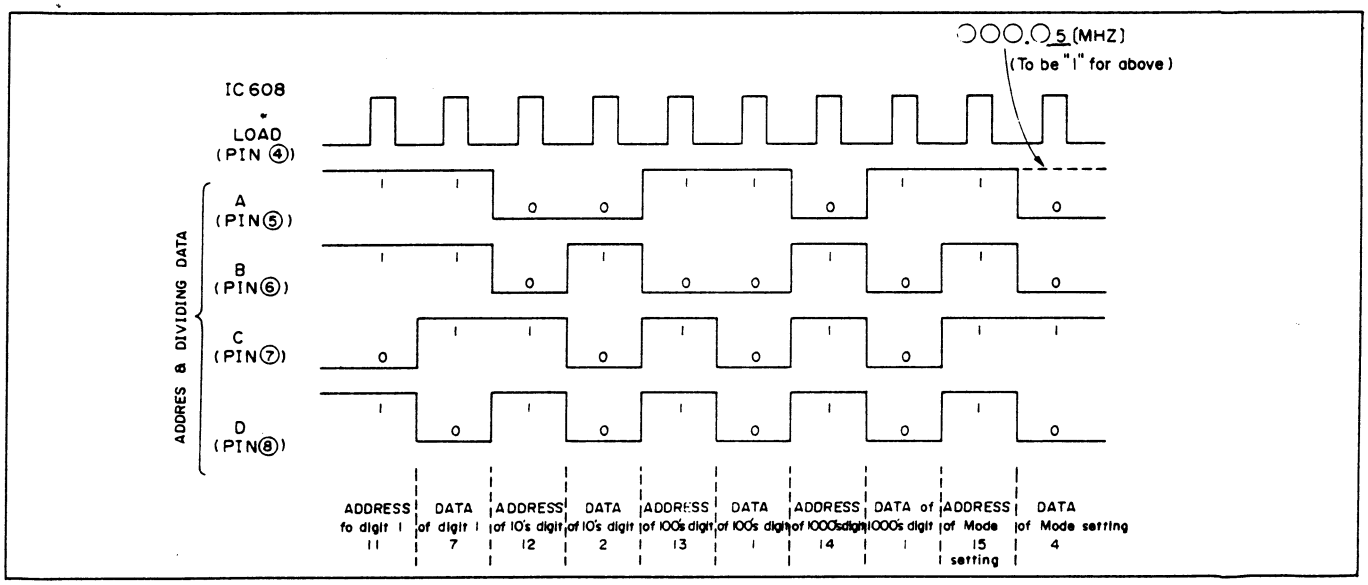
(4) Active Low Pass Filter (Q603–605 FM, Q606–608 AM)

The buffer output(s) (pins 14, 15) of IC608 (PLL) is applied to the low pass filter and the buffer output as digital signals is converted into an analog voltage. The analog voltage is then applied to the varactor diode to control the oscillator frequency in the tuner section.

(5) Frequency Dividing Data Signals from IC606 (microcomputer)

The data signals transferred from the IC606 to IC608 are developed only when the reception frequency is being changed, so a storage oscilloscope may be required to observe the wave forms of the data. The data output signals are classed into LOAD signals and DATA signals, and the DATA signals are further classed into Address signals and Data Set signals, each of which is developed alternately as shown in the example below:

Example: Data signals at reception of 102.00MHz (Frequency dividing ratio: 1127)



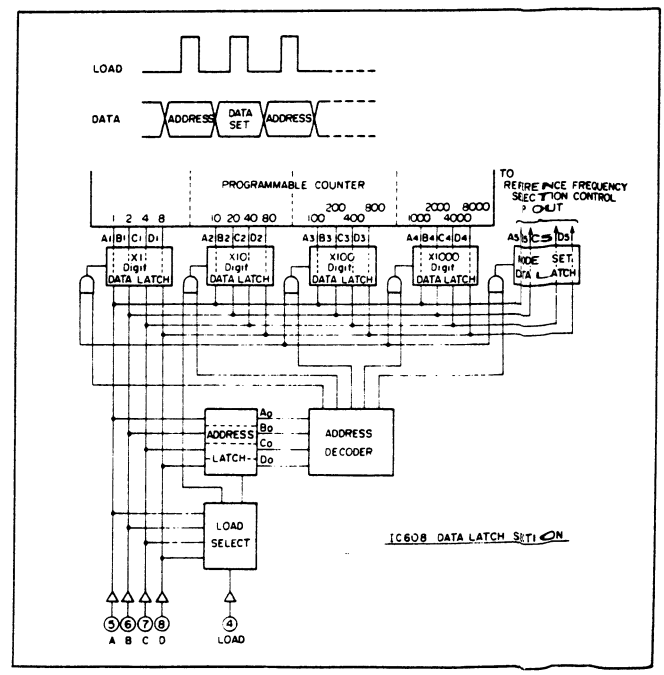
As can be seen from above illustration, the signals are developed in a sequence of Address Signals, Data Set signals, Address signals,

Since the signals are read in during the LOAD signal being set to "1" level, the address signal in first digit is read in firstly, and the signal is then led to the Address Decoder.

During next LOAD signal of "1", the Data Set signal in first digit is read into the LATCH whose address is determined by the signal from the address decoder (the signal read in earlier).

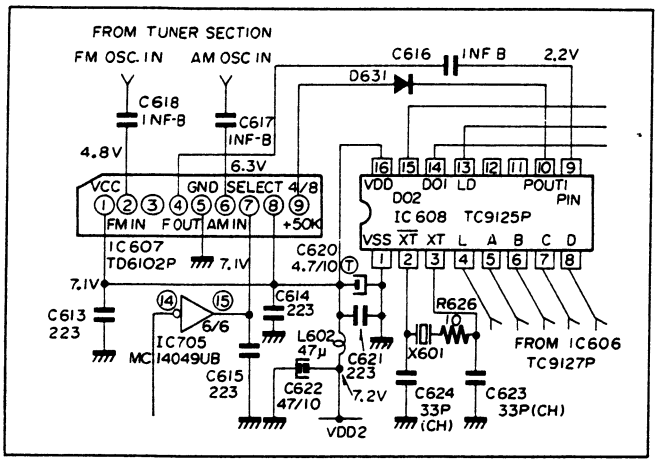
In this way, the data sets of 10's digit, 100's digit, and 1000's digit are read in and latched.

Mode set signals are signals to determine the reference frequency and frequency shift, and the combinations shown in the table below are used as the mode set signals.

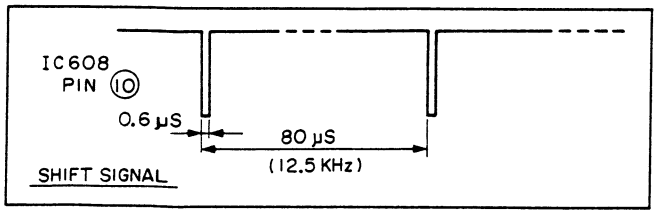


Mode STE Data from Micro-computer			Reference Frequency [kHz]	Frequency Division Output from Program Counter IC608		
C	B	A		PIN (10)	PIN (11)	
0	0	0	1	ON	OFF	
1	0	0	12.5	OFF	ON	►○○○.○ 0 [MHz]
1	0	1	12.5	ON	ON	►○○○.○ 5 [MHz]

NOTE: ON ..... frequency division output available
OFF ..... frequency division output not available because of "1" level set.



In the T555, to perform 50kHz ste[illegible]FM reception a SHIFT signal (signal with pulses extracted in IC[illegible]7) in negative logic is sent from pin 10 of IC608 to pin 9 of IC607 through a diode D631. The mode set data under this condition are A = "1", B = "0" and C = "1".

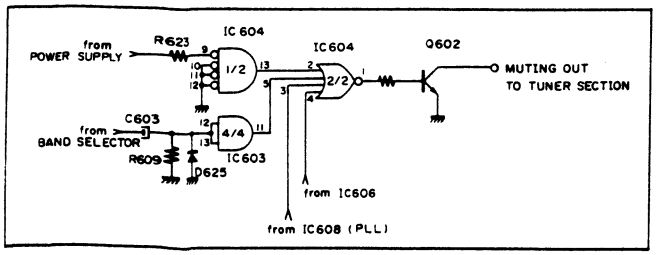


The signal is also developed during AM mode of operation, but gives no affection, since frequency dividing operation in IC607 is being disabled during AM operation.

3-5 Muting Control 1 IC604

(Control Section)

In the T555, muting operations are introduced for many operations to eliminate undesirable pop noises, etc.

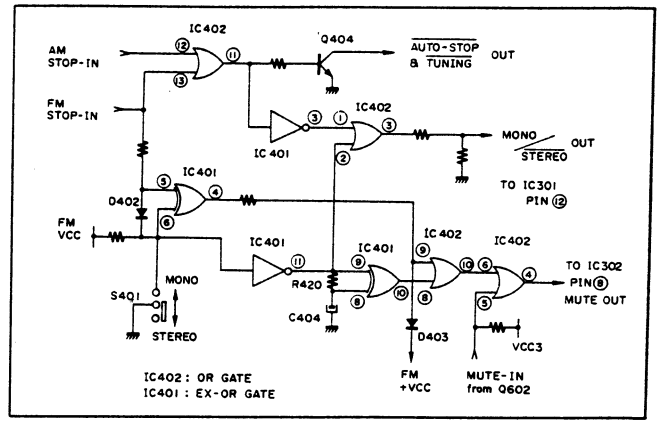


1. Muting during AUTO/MANUAL scanning
2. Muting during MEMORY selection
3. Muting during PLL Loop in lockout condition
4. Muting during Band Selection operation
5. Muting for power switch turned off.

In normal condition, pin 1 is in "1" level, and Q602 is being turned on. Under this condition, the muting operation is released. Now, if "1" level signal is applied to one or more of four NOR input gates of IC604-2/2 by a operation(s), pin 1 becomes to "0" level and Q602 is turned off, resuting in actuating muting circuit.

MUTING CONTROL 2 IC401, 402, 302

(Tuner Section)



This circuit is a control circuit for Tuner Section.

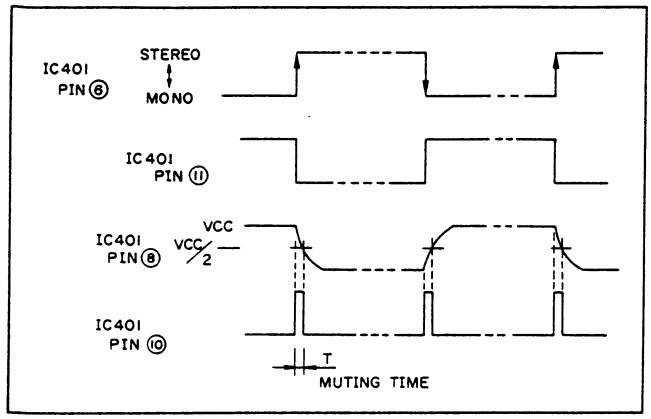
When Q602 in the control section is turned off, pin 5 of IC401 becomes "1" level, then pin 4 becomes "1" level regardless of conditions of pin 6, and send the MUTING signal to IC302 to perform the muting operation.

When S-401 is placed in the STEREO position and the tuner is tuned in a frequency correctly, the voltage potential at pin 12 of IC103 falls to a value less than 2V. Then the state of the Schmitt Trigger Q401 and Q402 is inverted, and collector potential of Q403 is increased and the voltage is applied to pin 13 of IC402. This voltage is also applied to pin 5 of IC401. Since pin 6 is in "1" level because of the STEREO position selected, pin 4 of IC401 becomes "0" level. This signal is then applied to pin 9 of IC402. Since pin 8 of IC402 is in "0" level (pin 8 becomes "1" level only when the S-401 is turned on or off and generates a muting signal), pin 10 is also "0" level. Under this condition, if no muting signal is applied from Q602, pin 4 of IC402 becomes "0" level and no muting signal develops at pin 4 of IC402. Namely muting operation is not performed.

Next, when the tuner is turned off, the voltage potential at pin 12 of IC103 increases to a level higher than 3V, and pin 5 becomes "0" level. Accordingly, pin 4 of IC401 becomes "1" level, as a result, pin 4 of IC402 also becomes "1" level, thus actuating the muting circuit.

On the other hand, if S-401 is placed in the MONO position, both pins 5 and 6 of IC401 are always in "0" level due to D402, and pin 4 is also in "0" level, muting at tuning off state is disabled. However, muting signals during tuning operation are sent from Q602, muting for that operation (approx. 0.5 sec for each operation) will function as usual.

Switching S401 (MONO/STEREO Switch) during FM mode of operation may cause noises from IC301, to prevent this a muting signal effective only for that switching period is generated.



The muting time T is given by

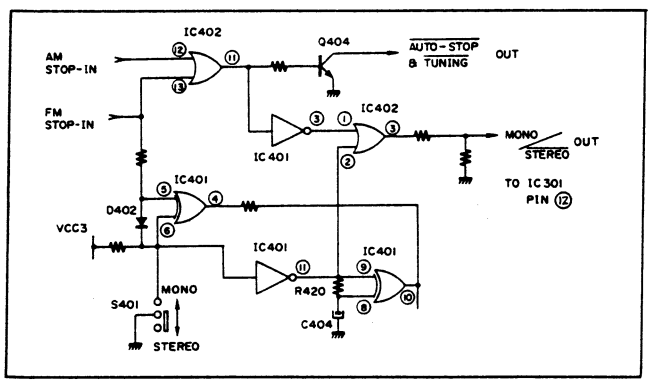
T = 0.69 C404 x R420

Substituting C404 = 0.1μF and R420 = 510 kohm into the equation provides:

T = 35.2 msec.

Namely, muting is actuated during this time period to cut undesirable noises.

3-6 MONO/STEREO Control & Auto-Stop Control Circuits



This circuit allows IC301 to operate in mono mode of operation to reduce undesirable noises, if the tuner is not tuned in a station correctly even the S401 is placed in the STEREO position.

Under tuning off condition, pin 13 of IC402 is in "0" level (pin 12 is always in "0" level during FM mode of operation).

Pin 3 of IC401 is inverted and becomes "1" level, then pin 3 of IC402 also becomes "1" level, thus the IC301 is controlled to operate in MONO mode.

AUTO-STOP

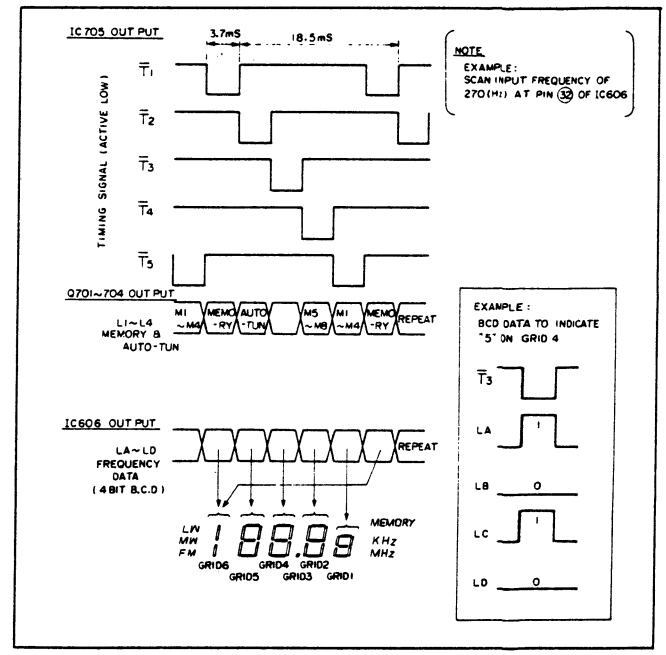
The Auto-Stop signal is an active low signal provided by making Q404 turn on. The auto-stop operation is conducted by applying "1" level signal to pin 12 (AM) and pin 13 (FM) of IC402.

In AM mode of operation, 450kHz signal level from the IF stage is detected, and in FM mode a level at pin 12 of IC103 is detected and each of them is applied to pin 12 and pin 13 of IC402, respectively. The signal is also used to light up the Tuning Indicator D504 in FM mode of operation. Therefore, the lighting sensitivity of D504 and the Auto-Stop sensitivity are identical.

3-7 Frequency & Memory Display

This circuit is used to provide "dynamic display" and consists of 7-segment Decoder and Driver.

Display timings are as follows:

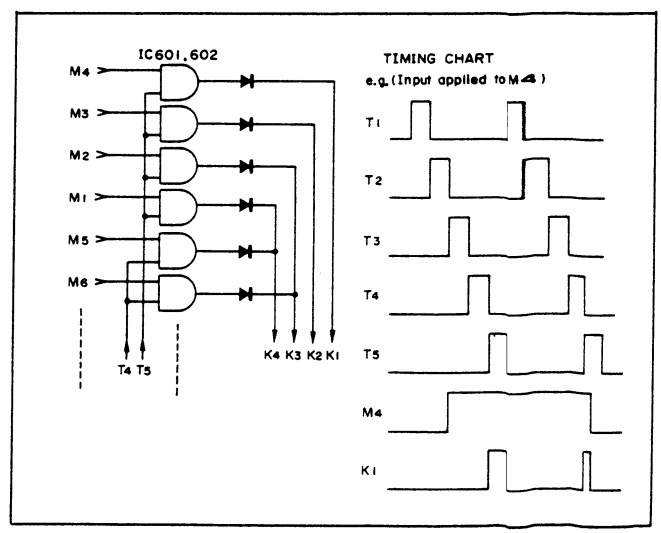


3-8 Key Encoder IC601–603

The key-input circuit for IC606 (microcomputer) is comprised of a matrix circuit.

Key position detecting data are provided by processing T1–T5 timing signals so that they appear at K1–K4.

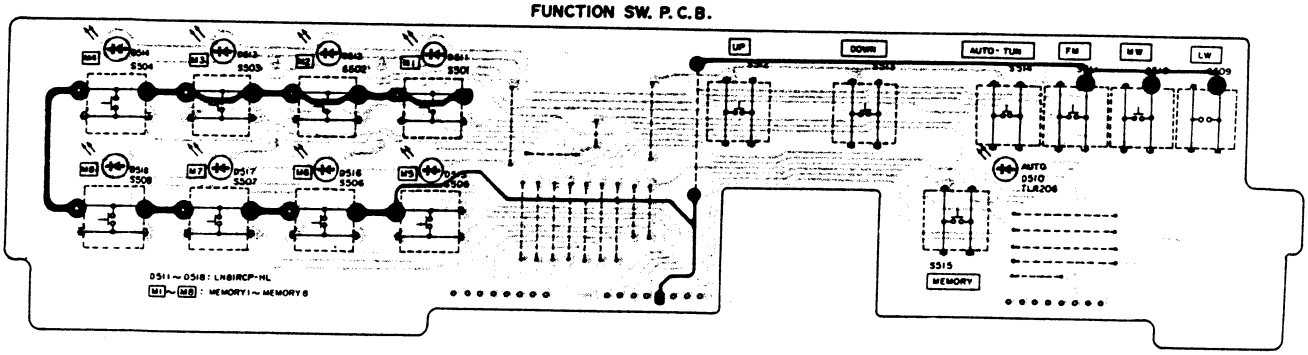
In the T555, these data are handlesd with AND gates to enable remote control operation.



SECTION 4
DIAGRAMS

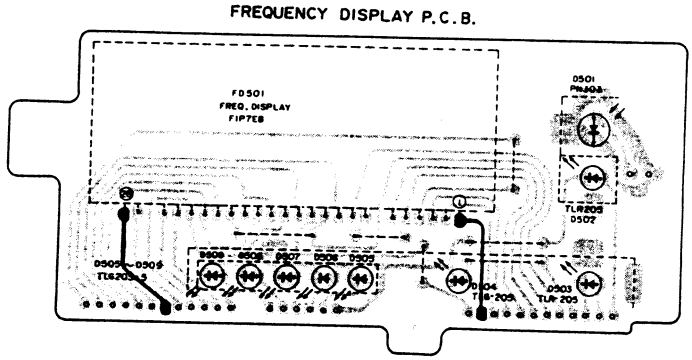
4-1: Mounting Diagram (A)

FUNCTION SW. P.C.B.



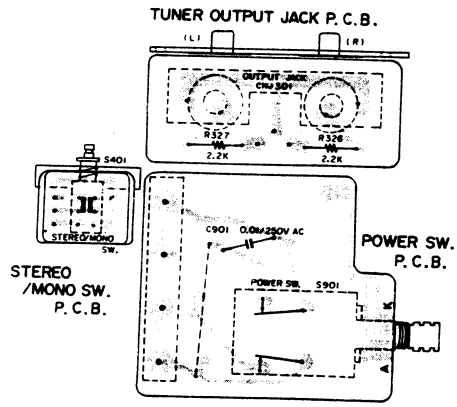
: B + Pattern

FREQUENCY DISPLAY P.C.B.

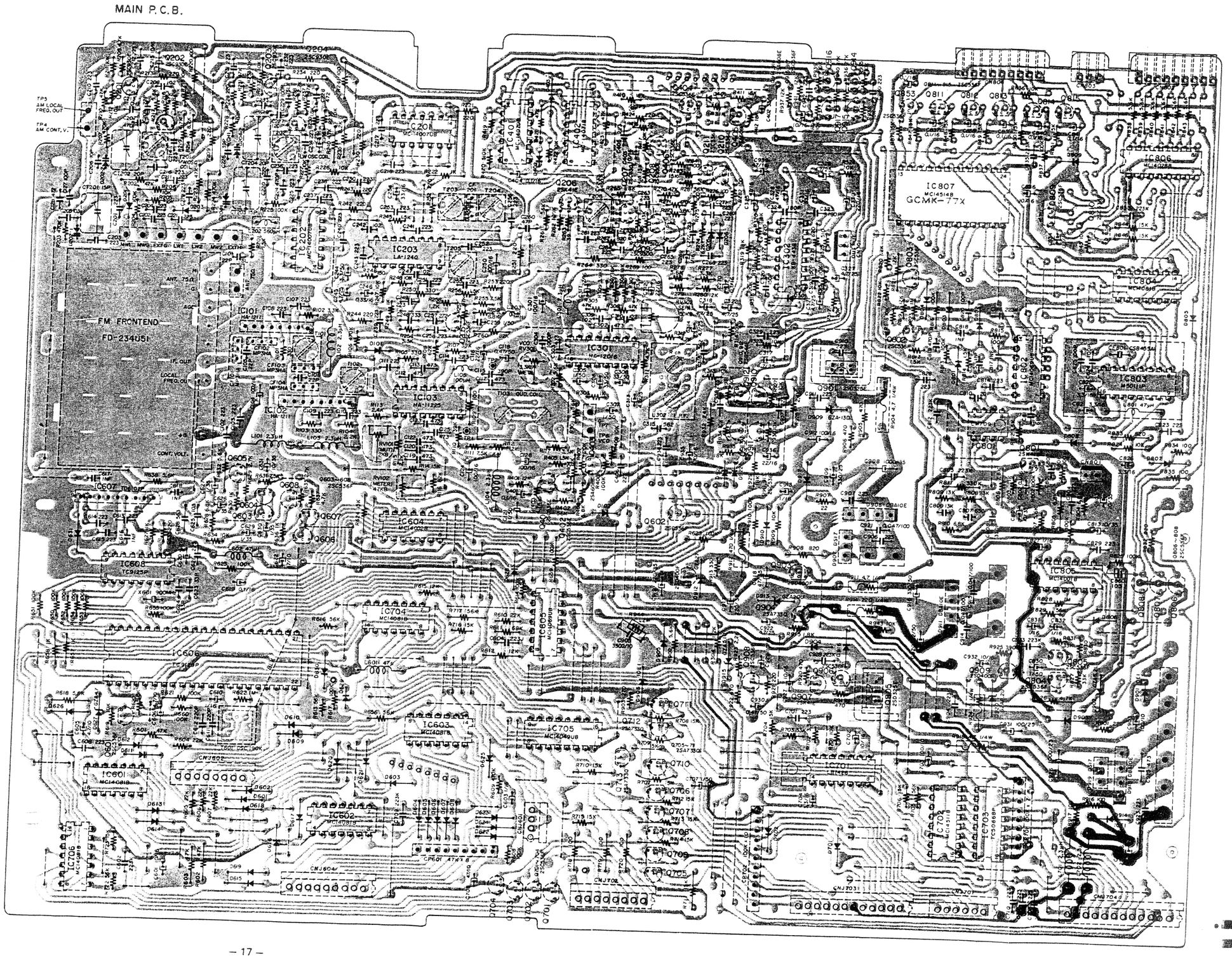


: B - Pattern

TUNER OUTPUT JACK P.C.B.

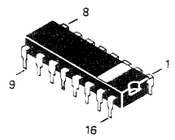


Mounting Diagram (B)

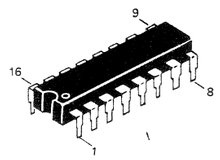


4-2: Replacement Semiconductors

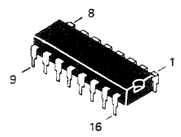
IC103 : HA11225
IC301 : HA12016



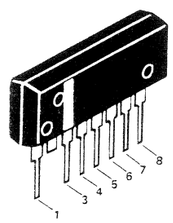
IC608 : TC9125P
IC702 : MC14511B
IC703 : TC5066BP
IC705 : MC14049UB
IC803 : M50111P
IC806 : MC14028B



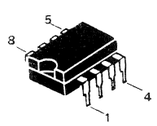
IC203 : LA1240
IC302 : KB4438



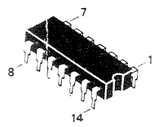
IC101, 102 : HA1211



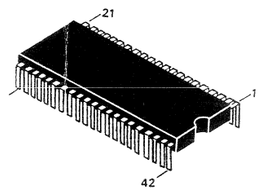
IC801 : LM709CN8



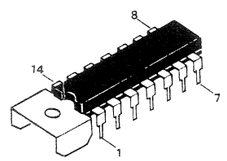
IC201, 202 : MC14007UB
IC401 : MC14070B
IC402 : MC14071B
IC601~603, 704, 706, 804 } MC14081B
IC604 : MC14002B
IC605, 802 : MC14069UB
IC805 : MC14001B



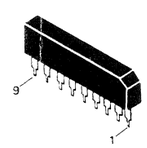
IC606 : TC9129P



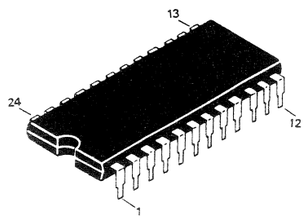
IC701 : LB1426



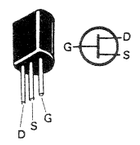
IC607 : TD6102P



IC807 : MC14514B



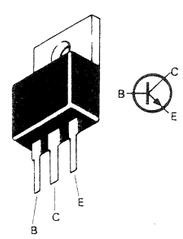
Q206, 801, 907 : 2SK41E



Q201 ~ 204, 207 ~ 209, Q205, 210 ~ 211, Q401 ~ 402, 404, 406, Q601 ~ 608, 701 ~ 704, Q802 ~ 815, 853, Q906, 908, 911, 913, Q915, 917 : 2SC930D / 2SC536E/F

Q403, 405, 914, 916 : 2SA608E
Q705 ~ 713, 904 : 2SA733Q

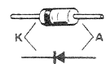
Q901, 905 : 2SD325E



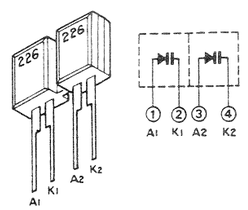
Q902, 903, 909 : 2SD400F

Q910, 912 : 2SB544E

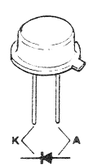
D101, 102, 201, 203, D205, 206, 301, 401 ~ 403, D601 ~ 626, 628 ~ 631, D701, 702, 801 ~ 809, D904, 905, 910, 916, D917, 921, 922, } 1S2473



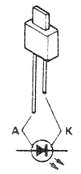
D202—1,2 } KV—1226
D204—1,2 }



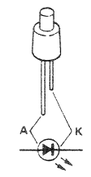
D501 : PN303



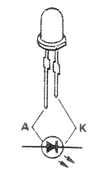
D502, 503 : TLR205
D504 ~ 508 : TLG205



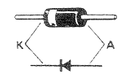
D510 : TLR206



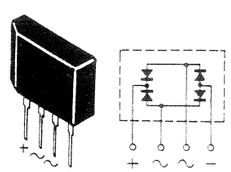
D511 ~ 518 : LN81RCPHL



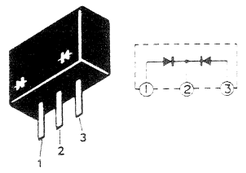
D901, 906, 914 : 10E1



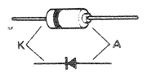
D908, 911, 918 : DBA10E



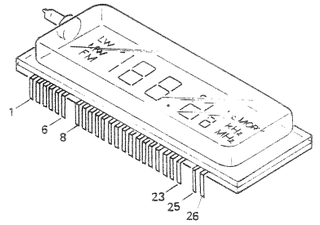
D907, 919 : DS17



D627 : GZA4.7
D902 : GZA6.2L
D909 : GZA13U
D912 : GZA27
D913 : GZA20U
D915 : GZA5.1U
D920 : GZA8.2U

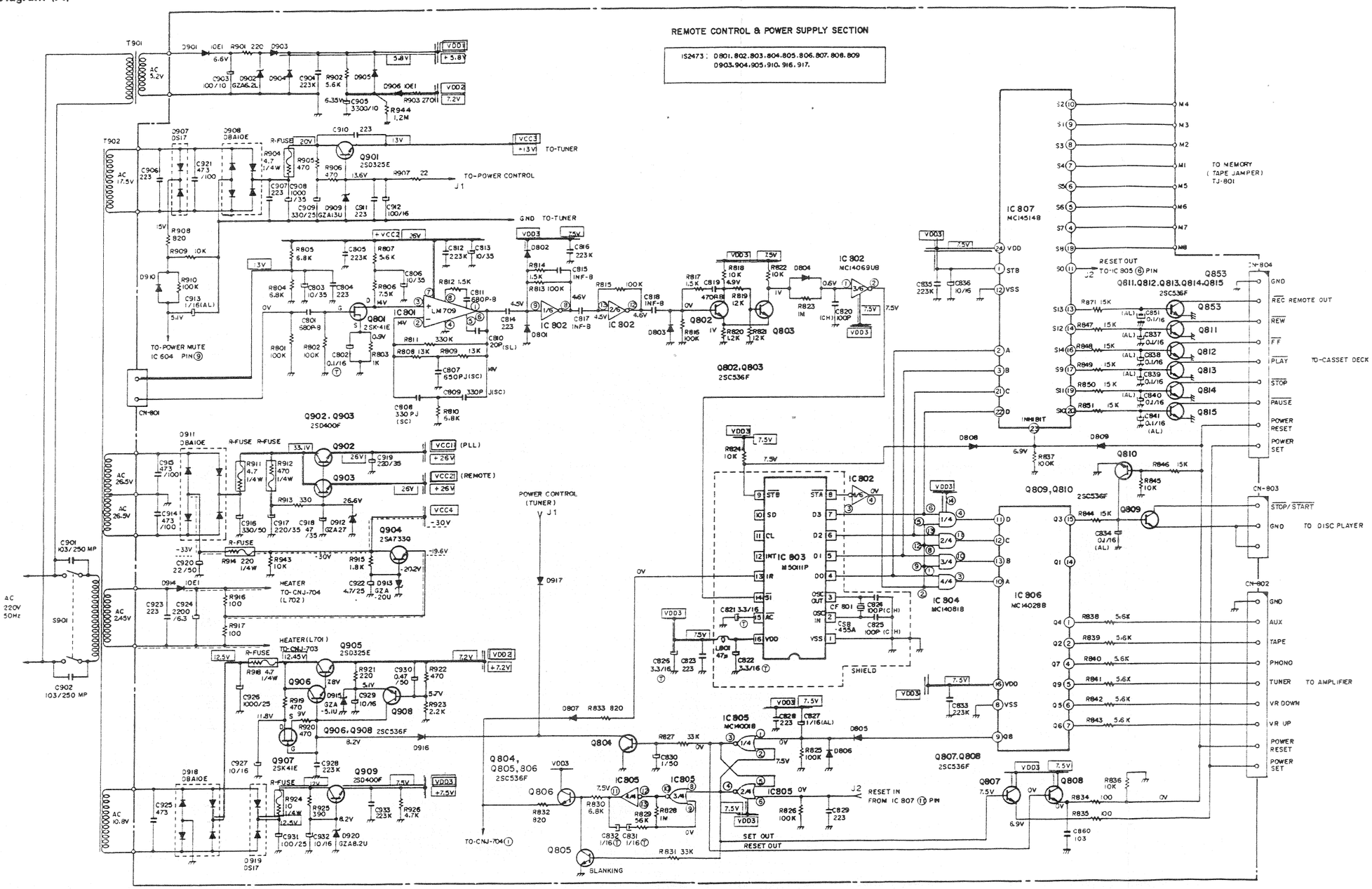


FD501 : FIP7C8



NO.	DESCRIPTION	NO.	DESCRIPTION
1	FILAMENT	14	PLATE (d)
2	PLATE (LW)	15	3 GRID
3	" (MW)	16	PLATE (g)
4	6 GRID	17	2 GRID
5	PLATE (b5, c5)	18	PLATTE (b1, e1)
6	" (a)	19	1 GRID
7	NO. PIN	20	PLATE (g1)
8	PLATE (b)	21	PLATTE(a1,c2,d1,f1)
9	" (f)	22	" (MEM)
10	5 GRID	23	" (KHz)
11	PLATE (e)	24	NO. PIN
12	" (c)	25	PLATTE (FM)
13	4 GRID	26	FILAMENT

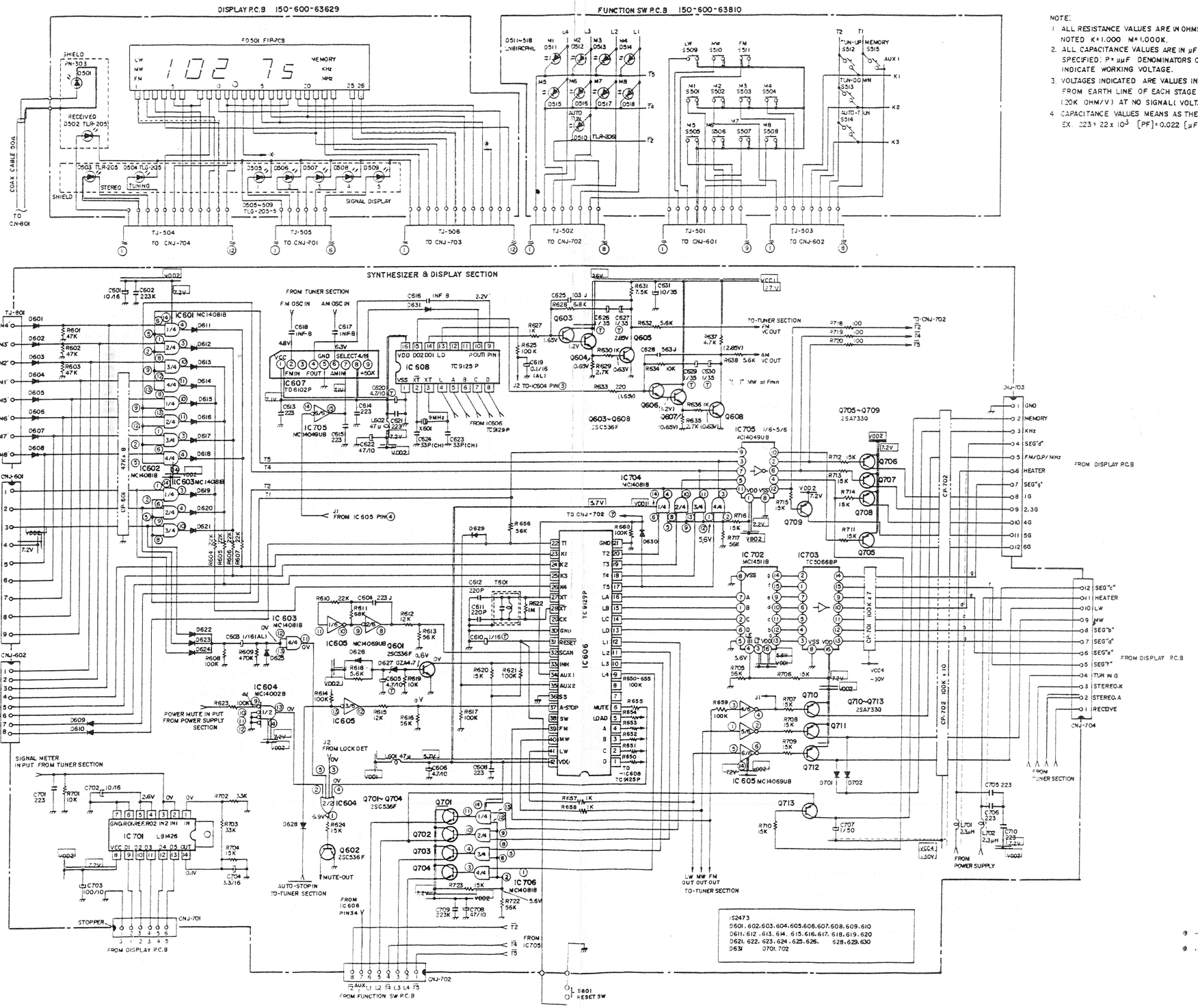
4-3: Schematic Diagram (A)



— : B + Line
... : B – Line

NOTE:
1. ALL RESISTANCE VALUES ARE IN OHMS 1/4W UNLESS OTHERWISE NOTED K=1.000 M=1.000K
2. ALL CAPACITANCE VALUES ARE IN μF UNLESS OTHERWISE SPECIFIED: P=μμF
   DENOMINATORS OF THE VALUES OF CAPACITORS INDICATE WORKING VOLTAGE
3. VOLTAGES INDICATED ARE VALUES IN FM OPERATION MEASURED FROM EARTH LINE OF EACH STAGE WITH A VOLTMETER (20K OHM/V) AT NO SIGNAL [VOLTAGES IN ( )=MW) < >=LW]
4. CAPACITANCE VALUES MEANS AS THE FOLLOWING EXAMPLE
   EX. 223=22x10³ [PF]=0.022 [μF]

Schematic Diagram (B)

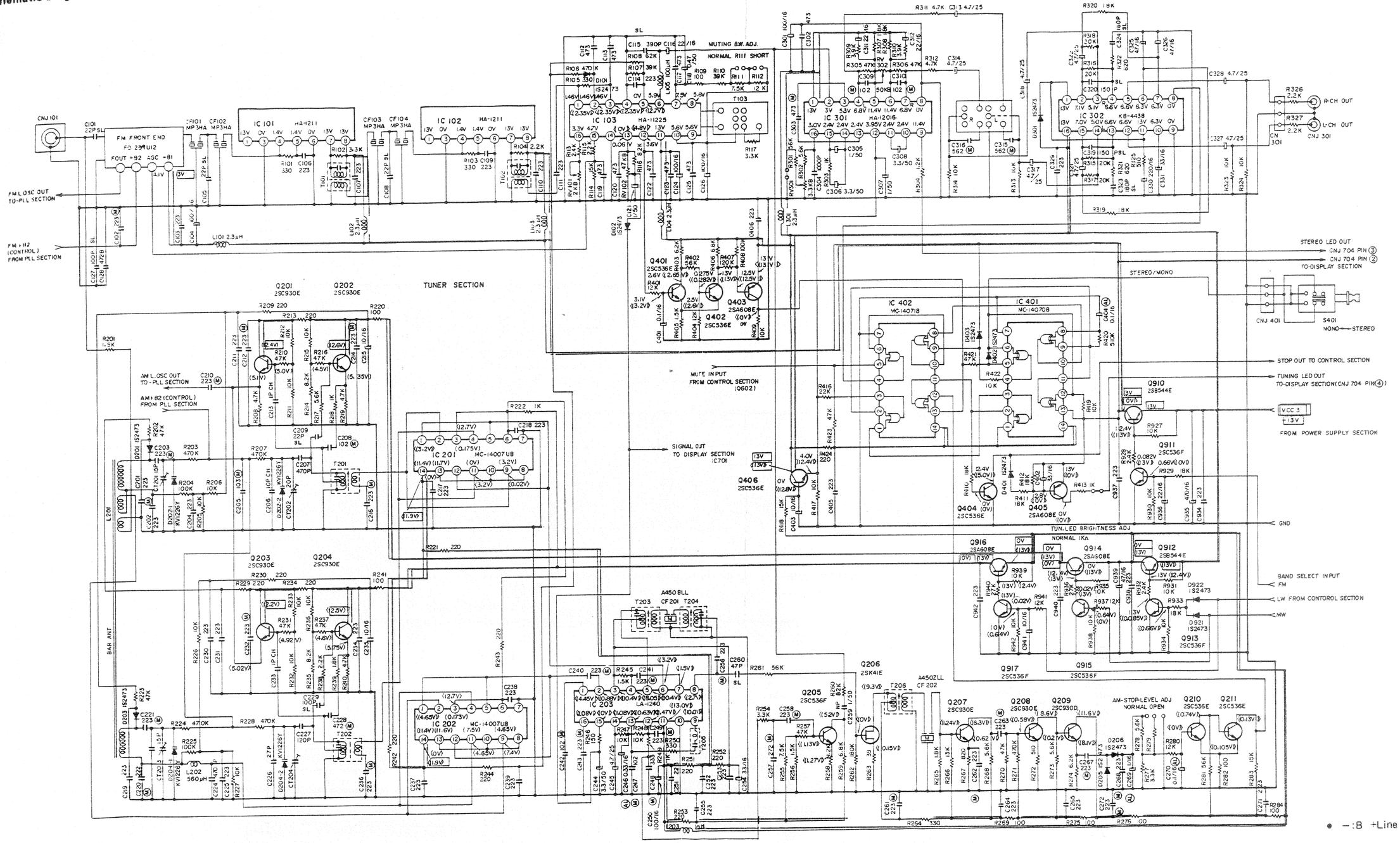


NOTE:

1. ALL RESISTANCE VALUES ARE IN OHMS 1/4W UNLESS OTHERWISE NOTED K=1.000 M=1.000K.
2. ALL CAPACITANCE VALUES ARE IN μF UNLESS OTHERWISE SPECIFIED: P=μμF. DENOMINATORS OF THE VALUES OF CAPACITORS INDICATE WORKING VOLTAGE.
3. VOLTAGES INDICATED ARE VALUES IN FM OPERATION MEASURED FROM EARTH LINE OF EACH STAGE WITH A VOLTMETER (20K OHM/V) AT NO SIGNAL(VOLTAGES IN ( )=MW( )=LW)
4. CAPACITANCE VALUES MEANS AS THE FOLLOWING EXAMPLE EX. $223 = 22 \times 10^{3}$ [PF] = 0.022 [μF]

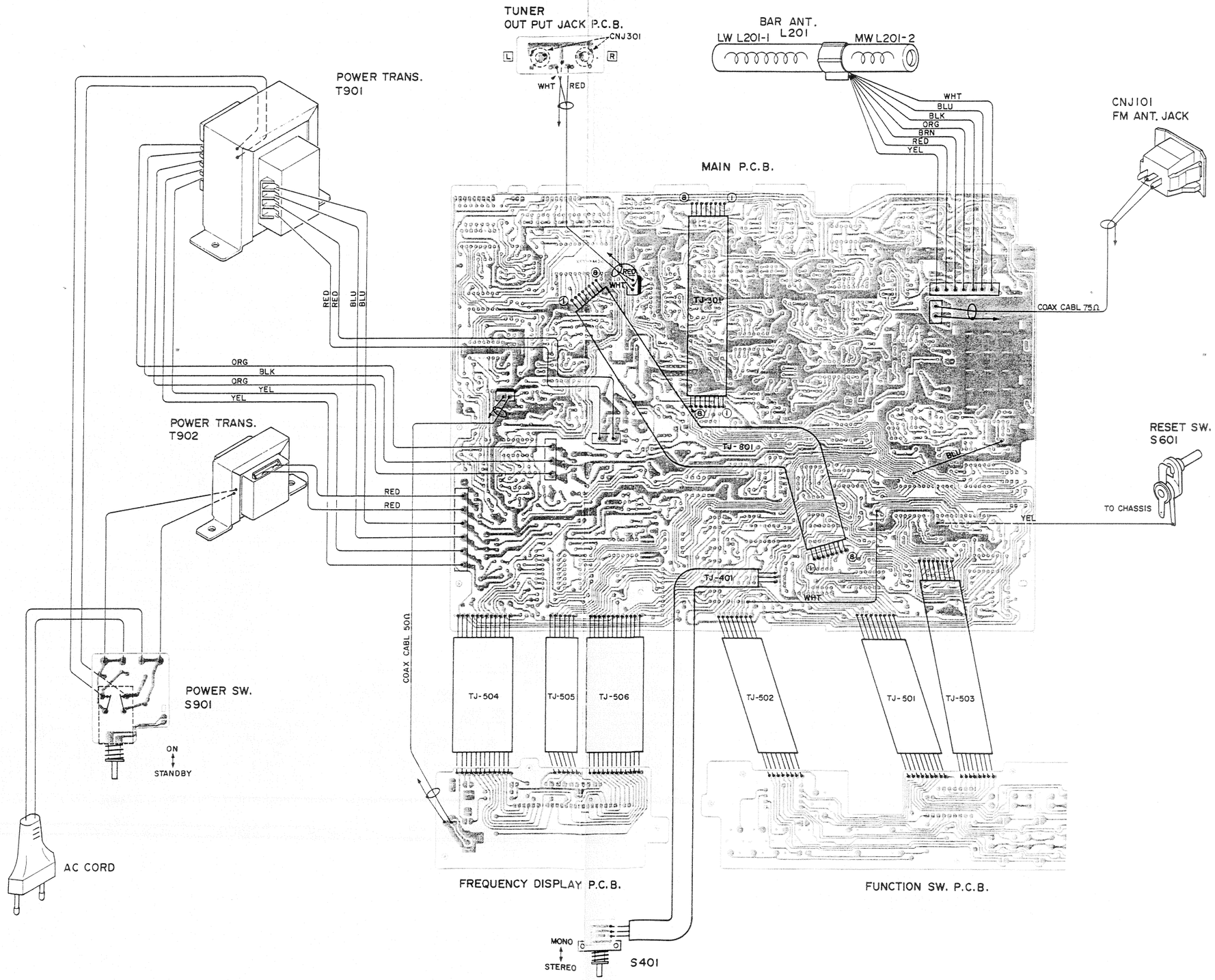
● — : B + Line
● ... : B - Line

Schematic Diagram (C)



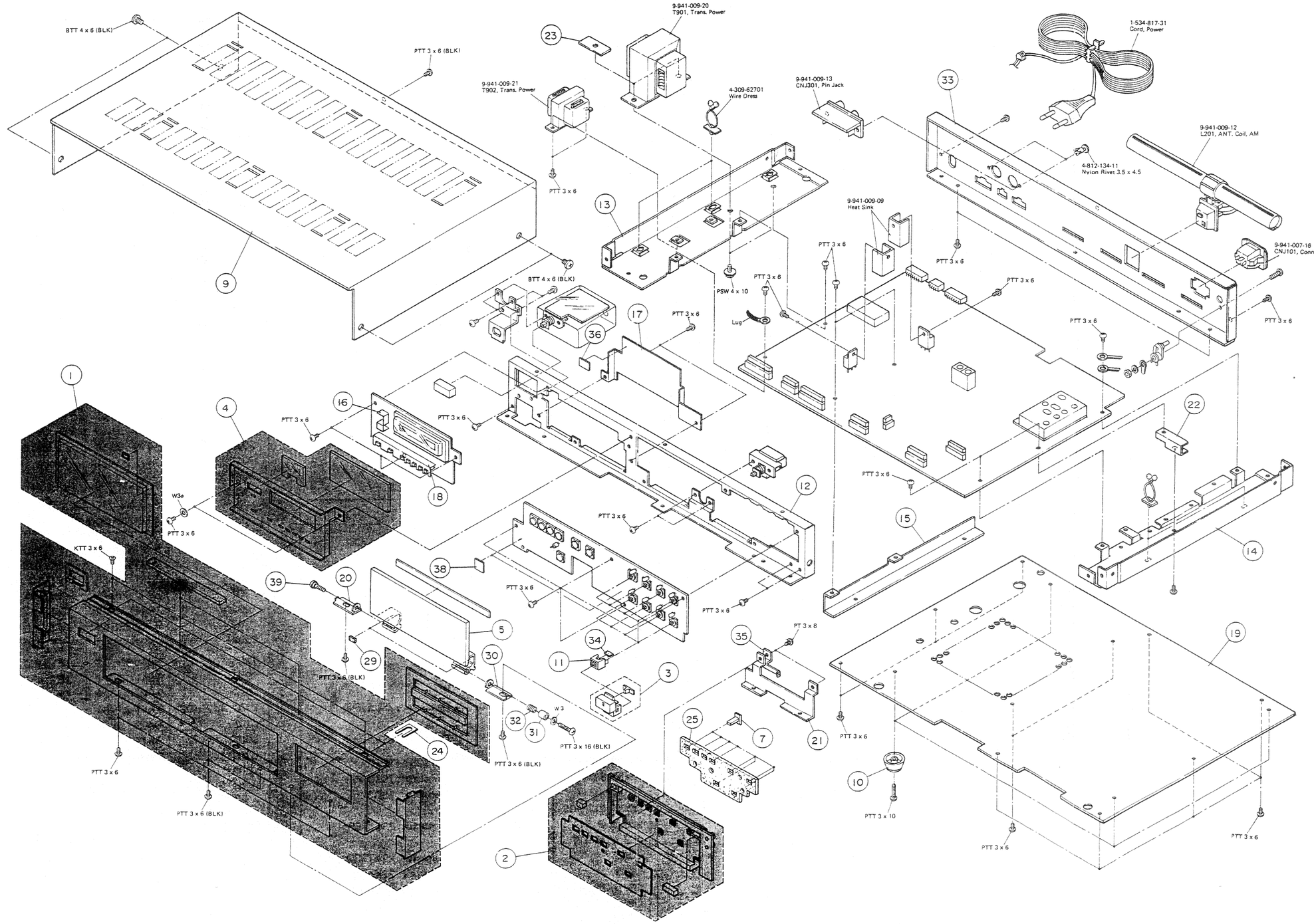
NOTE:
1. ALL RESISTANCE VALUES ARE IN OHMS 1/4W UNLESS OTHERWISE NOTED K=1,000 M=1,000K
2. ALL CAPACITANCE VALUES ARE IN μF UNLESS OTHERWISE SPECIFIED; P=μμF
   DENOMINATORS OF THE VALUES OF CAPACITORS INDICATE WORKING VOLTAGE
3. VOLTAGES INDICATED ARE VALUES IN FM OPERATION MEASURED FROM EARTH LINE OF EACH STAGE WITH A VOLTMETER (20K OHM/V) AT NO SIGNAL (VOLTAGES IN ( ) =MW < >= LW)
4. CAPACITANCE VALUES MEAN AS THE FOLLOWING EXAMPLE
   EX. 223= 22 x 10^3 [PF]= 0.022 [μF]

4-4: Wiring Diagram



SECTION 5
EXPLODED VIEW

Exploded View Cabinet



Parts List – Cabinet –

Illus. No.	Parts No.	Parts Name
1	9-941-011-29	Front Panel Ass'y
		(Front Panel)
		(Transparent Panel)
		(Escutcheon)
		(Plate, Side)
		(Escutcheon, Power Switch)
2	9-941-011-31	Housing Ass'y
		(Housing) (Magnet A)
		(Bracket) (Magnet B)
3	9-941-011-33	Knob Ass'y, Memory
4	9-941-009-25	Back Plate Ass'y
		(Back Plate)
		(Plate, Transparent (Counter))
		(Plate, Transparent (RX))
5	9-941-011-30	Door
6	9-941-011-32	Knob Ass'y, Power
7	9-941-011-34	Knob Function
9	9-941-009-31	Case
10	X486-131-21	Foot Ass'y
11	9-941-009-33	Ring, Flexible

Illus. No.	Parts No.	Parts Name
12	9-941-009-34	Front Chassis
13	9-941-009-35	Fram, (L)
14	9-941-009-36	Fram, (R)
15	9-941-009-37	Plate (A), Shield
16	9-941-009-38	Plate (B), Shield
17	9-941-009-39	Plate (C), Shield
18	9-941-009-40	Spacer, LED
19	9-941-009-41	Plate, Bottom
20	9-941-009-42	Bracket, Door
21	9-941-009-43	Bracket, Housing
22	9-941-009-44	Bracket, P.C. Board
23	9-941-009-45	Bracket, Trans.
24	9-941-006-73	Spacer
25	9-941-009-46	Cushion, Housing
26	9-941-009-47	P. Coil Spring
27	9-941-009-48	Spring Ass'y, Door
28	3-831-441-XX	Spacer, Power
29	9-911-844-XX	Cushion, Door
30	9-941-009-51	Bracket, Door
31	9-941-009-53	Color, Door
32	9-941-009-54	Spring, Dumper
33	9-941-009-57	Rear Panel
35	9-941-011-14	Bracket, GND
39	9-941-011-17	Special Screw, 3x10 (BLK)

SECTION 6
PARTS LIST

1. Electrical Parts List

Ref. No.	Parts No.	Description
SEMICONDUCTORS		
–ICs –		
IC101, 102	9-941-008-65	IC, HA-1211
IC103	1-806-066-11	IC-HA-11225
IC201, 202	8-759-040-07	IC, MG-14007UB
IC203	812-40	IC, LA-1240
IC301	8-759-320-16	IC, HA-12016
IC302	9-941-008-79	IC, KB 4438
IC401	8-759-040-70	IC, MC-14070B
IC402	8-759-040-71	IC, MC-14071B
IC601, 602, 603	8-759-040-81	IC, MC-14081B
IC604	8-759-040-02	IC, MC-14002B
IC605	8-759-040-69	IC, MC 14069UB
IC607	8-941-261-02	IC, TD6102P
IC608	8-759-291-25	IC, TC9125P
IC701		IC, LB1426
IC702	8-759-045-11	IC, MC14511B
IC703	8-759-250-66	IC, TC5066BP
IC704, 706	8-759-040-81	IC, MC14081B
IC705	8-759-040-49	IC, MC14049UB
IC801	9-941-008-98	IC, LM709CN-8
IC802	8-759-040-69	IC, MC14069UB
IC803	8-759-040-99	IC, M50111P
IC804	8-759-040-81	IC, MC14081B
IC805	8-759-040-01	IC, MC14001B
IC806	8-759-040-28	IC, MC14028B
IC807	9-941-009-01	IC, MC14514B
IC606	9-941-008-87	IC, TC9129P
–Transistors –		
Q201, 202, 203	8-729-803-05	Transistor, 2SC930E
Q205	8-729-803-03	Transistor, 2SC536F
Q801	9-941-011-41	FET, 2SK41E
Q209	8-729-803-14	Transistor, 2SC930D
Q210, 211	8-729-803-03	Transistor, 2SC536E
Q401, 402, 404	8-729-803-03	Transistor, 2SC536E
Q403, 405	8-729-860-80	Transistor, 2SA608E
Q601, 602, 603 604, 605, 606, 607, 608	8-729-836-16	Transistor, 2SC536F
Q701, 702, 703, 704	8-729-836-16	Transistor, 2SC536F
Q705, 706, 707, 708	80729-173-36	Transistor, 2SA733Q
Q206	9-941-008-78	FET, 2SK41E
Q802~815, 853	8-729-836-16	Transistor, 2SC536F
Q901, 905	9-941-009-06	Transistor, 2SD325E
Q902, 903, 906, 908, 909, 911, 913, 915, 917	8-729-836-16	Transistor, 2SC536F
Q904	8-729-173-38	Transistor, 2SA733Q
Q907	–	Transistor, 2SK41E
Q910, 912	9-941-009-07	Transistor, 2SB544E
Q914, 916	8-729-860-80	Transistor, 2SA608E
Q902, 903, 909	9-941011-42	Transistor, 2SD400F

Ref. No.	Parts No.	Description
–Diodes –		
D101, 102	8-719-924-73	Diode, 1S2473
D201, 203, 205	8-719-924-73	Diode, 1S2473
D202-1.2, 204-1.2	8-719-912-27	Diode, Vari Cap KV1226
D401, 402, 403	8-719-924-73	Diode, 1S2473
D501	9-941-008-83	Diode, Photo PN303
D502, 503	8-719-802-05	LED, TLR 205
D504, 505, 506	8-719-812-05	LED, TLG 205
D510	9-914-008-85	LED, TLR 206
D511, 512, 513, 514, 515	9-914-008-86	LED, LN81RCPHL
D601~631	8-719-924-73	Diode, 1S2473
D627	9-941-008-88	Diode, Zener GZA4.7
D701, 702	8-719-924-73	Diode, 1S2473
D801~809	8-719-924-73	Diode, 1S2473
D901, 906, 914	8-719-200-01	Diode, 10E1
D902	8-719-162-55	Diode, Zener GZA6.2L
D903, 904, 905, 910	8-7190924-73	Diode, 1S2473
D907, 919	9-941-009-08	Diode, DS17
D908, 911, 918	8-719-200-01	Diode, DBA10E
D909	8-719-113-57	Diode, Zener GZA13U
D912	8-719-107-56	Diode, Zener GZA27
D913	8-719-120-57	Diode, Zener GZA20U
D915	8-719-751-57	Diode, Zener GZA5.1U
D920	8-719-782-57	Diode, Zener GZA8.2U
D205, 206	8-719-924-73	Diode, 1S2473
D505, 506, 507, 508, 509	9-941-011-39	LED, TLG205-5
TRANS' COILS & FILTERS		
T101	9-941-008-66	IFT, 10.7MHz
T102	9-941-008-67	IFT, 10.7MHz
T103	9-941-008-68	IFT, 10.7MHz
T201	9-941-008-71	Coil, OSC. MW
T202	9-941-008-72	Coil, OSC. LW
T203	1-409-323-00	IFT, 450
T204	1-409-324-00	IFT, 450
T205	9-941-008-73	IFT, 450
T206	9-941-008-74	IFT, 450
T601	9-941-008-89	Coil, OSC.
L101, 102, 103	9-941-008-69	Coil, Choke
L105	1-408-129-11	Micro Inductor
L201	9-941-009-12	FER. Rite-Rod
L202	9-941-008-76	Coil, 560μH
L203	9-941-008-77	Coil, Choke 1mH
L301	9-941-008-80	Coil, Choke 2.3μH
L302	1-231-157-00	Filter, Low Pass
L601, 602	9-941-008-91	Coil, Choke 4.7μ
L701, 702	9-941-008-96	Coil, Choke 4.7μ
L801	9-941-009-03	Coil, Choke (47μ)
CF101, 102, 103 C104	1-527-567-11	Filter, Ceramic
CF201	1-527-403-00	Filter, Mechanical 450K
CF202	9-941-008-75	Filter, Mechanical 450K
CF801	9-941-009-02	Filter, Ceramic CSB455A

Ref. No.	Parts No.	Description
RESISTORS *All Resistors are in Ω. Common 1/4W Carbon resistors are omitted. Refer to the list on Page 00 for their part numbers.*		
RV101	1-226-234-00	RES, ADJ, Carbon 80mm 2K
RV102	9-941-008-70	RES, ADJ, Carbon 6.0mm 47Kohm
RV301	9-941-008-81	RES, ADJ, Metal Graze 3.3KB
RV302	1-226-238-00	RES, ADJ, Carbon 50KB
CAPACITORS *All capacitors are in μF and ceramic unless otherwise noted. 50WV or less are not indicated excepted for electrolytics. Common Capacitors are omitted. Refer to the lists on Pages 00 and 00 for their part numbers.*		
CT201, 203	1-141-180-00	Cap Trimmer
CT202, 204	1-141-171-00	Cap Trimmer
CP601	9-941-008-93	Encapsulated
CP701	9-941-008-94	Encapsulated
CP702, 703	9-941-008-95	Encapsulated
MISCELLANEOUS		
	9-941-008-64	FM Front End
FD501	1-519-209-00	Indicater Tube Fluorescent F1P7C8
FD501		Indicator Tube Fluorescent F1P7E8
X601	9-941-008-92	OSC, Illator, Crystal (9MHz)
S401	9-941-009-14	Switch, Push
S510, 502, 503, 504, 505, 506, 507, 508	1-552-412-00	Switch, Key
S509~514	1-552-539-00	Switch, Key
S901	1-552-992-12	Switch, Push (Power)
	1-535-120-00	Terminal with Base (7P)
	1-535-116-00	Terminal with Base (2P)
	9-941-000-18	Terminal with Base (2P)
	9-941-009-10	Terminal with Base (3P) P=7.5
	9-941-009-11	Terminal with Base (6P) 7.5mm
CNJ101	9-941-007-16	Connector Jack (ANT)
CN310	9-941-008-82	Connector 3P
CNJ401	1-561-439-00	Connector (3P)
CNJ310	1-561-009-13	Jack Pin (2P)
CNJ601	1-561-445-00	Connector (9P)
CNJ602	1-561-444-00	Connector (8P)
CNJ701	1-561-442-00	Connector (6P)
CNJ702	1-561-444-00	Connector (8P)
CNJ703, 704	9-941-008-97	Connector (12P)
CN801	9-941-009-05	Connector (2P)
CN802, 804	7-560-263-00	Connector (9P)
CN803	7-560-280-00	Connector (3P)
	1-534-817-31	Cord Power
	1-551-553-00	Cord, Connector PIN-PIN
	9-941-008-89	Case, Seieid
	9-941-009-09	Heat Sink

Ref. No.	Parts No.	Description
	9-941-000-50	Stopper Cord
	9-941-009-15	Printed, Circuit Board Main
	9-941-009-17	Printed, Circuit Board Main
	9-941-009-18	Printed, Circuit Board Main
A1, 2B1, 2C1, 2	9-941-009-19	Printed, Circuit Board Main
T901	9-941-009-20	Transformer Power
T901	9-941-01147	Transformer Power
	9-941-011-44	Printed Circuit Board Main
	9-941-011-45	Printed Circuit Board Main
	9-941-011-43	Switch Push
T902	9-941-009-21	Transformer Power
T902	9-941-011-48	Transformer Power

ACCESSORIES AND PACKING MATERIALS

Illus. No.	Parts No.	Description
1	9-941-009-49	Cushion
2	3-701-626-01	Poly Bag
3	9-941-011-35	Poly Bag, Accessor
4	9-941-011-36	Individual Carton
5	9-941-011-37	Instruction Manual

2. Electrical Parts List – Common –

ELECTROLYTIC CAPACITORS

Note: Circled letter (Ⓐ to Ⓩ) are applicable to European models only.

CAP. (μF)	RATING → : Use the high voltage rated one.					
	6.3 VOLT.	10 VOLT.	16 VOLT.	25 VOLT.	35 VOLT.	50 VOLT.
	PART No.	PART No.	PART No.	PART No.	PART No.	PART No.
0.47					→	1-121-726-00 Ⓐ
1.0					→	1-121-391-00 Ⓐ
2.2					→	1-121-450-00 Ⓐ
3.3	→	→	→	1-121-392-00 Ⓐ	→	1-121-393-00 Ⓐ
4.7	→	→	→	1-121-395-00 Ⓐ	→	1-121-396-00 Ⓐ
10	→	→	1-121-651-00 Ⓐ	1-121-398-00 Ⓐ	→	1-121-738-00 Ⓐ
22	→	→	1-121-479-00 Ⓐ	1-121-480-00 Ⓐ	1-121-662-00 Ⓐ	1-121-152-00 Ⓐ
33	→	→	1-121-403-00 Ⓐ	1-121-404-00 Ⓐ	1-121-652-00 Ⓑ	1-121-405-00 Ⓐ
47	→	1-121-352-00 Ⓐ	1-121-409-00 Ⓐ	1-121-410-00 Ⓐ	1-121-653-00 Ⓑ	1-121-411-00 Ⓐ
100	→	1-121-414-00 Ⓐ	1-121-415-00 Ⓐ	1-121-416-00 Ⓐ	1-121-357-00 Ⓑ	1-121-417-00 Ⓑ
220	1-121-419-00 Ⓑ	1-121-420-00 Ⓑ	1-121-421-00 Ⓐ	1-121-422-00 Ⓑ	1-121-261-00 Ⓒ	1-121-423-00 Ⓑ
330	1-121-751-00 Ⓑ	1-121-805-00 Ⓑ	1-121-521-00 Ⓒ	1-121-654-00 Ⓑ	1-121-655-00 Ⓓ	1-121-656-00 Ⓒ
470	1-121-424-00 Ⓑ	1-121-425-00 Ⓒ	1-121-426-00 Ⓒ	1-121-733-00 Ⓑ	1-121-361-00 Ⓔ	1-121-810-00 Ⓓ
1000	–	1-121-736-00 Ⓒ	1-121-245-00 Ⓓ	1-121-657-00 Ⓓ	1-121-388-00 Ⓔ	1-123-061-00 Ⓕ
2200	1-121-658-00 Ⓑ	1-121-659-00 Ⓒ	1-121-660-00 Ⓓ	1-123-067-00 Ⓕ	1-121-984-00 Ⓙ	–
3300	1-121-661-00 Ⓓ	1-123-075-00 Ⓔ	1-123-071-00 Ⓕ	–	–	–

CAP. (μF)	100 VOLT.	160 VOLT.	250 VOLT.	350 VOLT.
	PART No.	PART No.	PART No.	PART No.
0.47	–	–	–	–
1.0	1-123-249-00 Ⓐ	1-123-252-00 Ⓐ	1-123-003-00 Ⓑ	1-121-168-00 Ⓑ
2.2	1-123-250-00 Ⓐ	1-123-026-00 Ⓑ	–	1-123-028-00 Ⓑ
3.3	1-121-995-00 Ⓐ	–	1-123-004-00 Ⓑ	1-123-006-00 Ⓒ
4.7	1-123-255-00 Ⓐ	1-121-246-00 Ⓑ	1-121-759-00 Ⓑ	1-123-007-00 Ⓓ
10	1-121-126-00 Ⓑ	1-121-999-00 Ⓑ	1-123-254-00 Ⓒ	1-123-008-00 Ⓓ
22	1-121-996-00 Ⓒ	1-123-253-00 Ⓒ	1-123-005-00 Ⓓ	1-123-022-00 Ⓓ
33	1-121-997-00 Ⓒ	1-121-757-00 Ⓒ	–	–
47	1-123-251-00 Ⓒ	1-121-919-00 Ⓒ	–	–
100	1-123-084-00 Ⓔ	–	–	–

CERAMIC CAPACITORS Ⓐ

CAP. (pF)	RATING 50 VOLT. PART No.	CAP. (pF)	50 VOLT. PART No.	CAP. (pF)	50 VOLT. PART No.	CAP. (μF)	50 VOLT. PART No.
0.5	1-101-837-00	22	1-102-959-00	150	1-101-361-00	0.001	1-102-074-00
0.75	1-101-586-00	24	1-102-960-00	160	1-101-367-00	0.0012	1-102-118-00
1.0	1-102-934-00	27	1-102-961-00	180	1-102-976-00	0.0015	1-102-119-00
1.5	1-101-576-00	30	1-102-962-00	200	1-102-977-00	0.0018	1-102-120-00
2.0	1-102-935-00	33	1-102-963-00	220	1-102-978-00	0.0022	1-102-121-00
3	1-102-936-00	36	1-102-964-00	240	1-102-979-00	0.0027	1-102-122-00
4	1-102-937-00	39	1-102-965-00	270	1-102-980-00	0.0033	1-102-123-00
5	1-102-942-00	43	1-102-966-00	300	1-102-981-00	0.0039	1-102-124-00
6	1-102-943-00	47	1-101-880-00	330	1-102-820-00	0.0047	1-102-125-00
7	1-102-944-00	51	1-101-882-00	360	1-102-821-00	0.0056	1-102-126-00
8	1-102-945-00	56	1-101-884-00	390	1-102-822-00	0.0068	1-102-127-00
9	1-102-946-00	62	1-101-886-00	430	1-102-823-00	0.0082	1-102-128-00
10	1-102-947-00	68	1-101-888-00	470	1-102-824-00	0.01	1-102-129-00
11	1-102-948-00	75	1-101-890-00	510	1-101-059-00	0.022	1-101-005-00
12	1-102-949-00	82	1-102-971-00	560	1-102-115-00	0.047	1-101-006-00
13	1-102-950-00	91	1-102-972-00	680	1-102-116-00		
15	1-102-951-00	100	1-102-973-00	820	1-102-117-00		
16	1-102-952-00	110	1-102-815-00				
18	1-102-953-00	120	1-102-816-00				
20	1-102-958-00	130	1-101-081-00				

0.001μF = 1,000pF

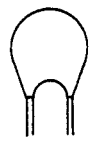
CERAMIC (SEMICONDUCTOR) CAPACITORS Ⓐ

CAP. (μF)	RATING → : Use the high voltage rated one. 25 VOLT. PART No.	50 VOLT. PART No.	CAP. (μF)	25 VOLT. PART No.	50 VOLT. PART No.
0.001	→	1-161-039-00	0.018	1-161-016-00	1-161-054-00
0.0012	→	1-161-040-00	0.022	1-161-017-00	1-161-055-00
0.0015		1-161-041-00	0.027	1-161-018-00	1-161-056-00
0.0018		1-161-042-00	0.033	1-161-019-00	1-161-057-00
0.0022		1-161-043-00	0.039	1-161-010-00	1-161-058-00
0.0027	→	1-161-044-00	0.047	1-161-021-00	1-161-059-00
0.0033	→	1-161-045-00	0.056	→	1-161-060-00
0.0039	→	1-161-046-00	0.068	→	1-161-061-00
0.0047	→	1-161-047-00	0.082	1-161-024-00	1-161-062-00
0.0056	→	1-161-048-00	0.1	1-161-025-00	1-161-063-00
0.0068	→	1-161-049-00			
0.0082	1-161-012-00	1-161-050-00			
0.01	1-161-013-00	1-161-051-00			
0.012	→	1-161-052-00			
0.015	1-161-015-00	1-161-053-00			

MYLAR CAPACITORS Ⓐ

Note: Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

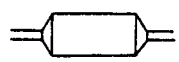
CAP. (μF)	RATING 50 VOLT. PART No.	100 VOLT. PART No.	200 VOLT. PART No.	CAP. (μF)	50 VOLT. PART No.	100 VOLT. PART No.	200 VOLT. PART No.	CAP. (μF)	50 VOLT. PART No.	100 VOLT. PART No.	200 VOLT. PART No.
0.001	1-108-227-00	1-108-365-00	1-108-409-00	0.01	1-108-239-00	1-108-377-00	1-108-421-00	0.1	1-108-251-00	1-108-389-00	1-108-433-00
0.0012	1-108-351-00	1-108-366-00	1-108-410-00	0.012	1-108-357-00	1-108-378-00	1-108-422-00	0.12	1-108-363-00	1-108-390-00	1-108-434-00
0.0015	1-108-228-00	1-108-367-00	1-108-411-00	0.015	1-108-240-00	1-108-379-00	1-108-423-00	0.15	1-108-252-00	1-108-391-00	1-108-435-00
0.0018	1-108-352-00	1-108-368-00	1-108-412-00	0.018	1-108-358-00	1-108-380-00	1-108-424-00	0.18	1-108-364-00	1-108-392-00	1-108-436-00
0.0022	1-108-230-00	1-108-369-00	1-108-413-00	0.022	1-108-242-00	1-108-381-00	1-108-425-00	0.22	1-108-254-00	1-108-393-00	1-108-437-00
0.0027	1-108-353-00	1-108-370-00	1-108-414-00	0.027	1-108-359-00	1-108-382-00	1-108-426-00	0.27	1-108-854-00	–	–
0.0033	1-108-232-00	1-108-371-00	1-108-415-00	0.033	1-108-244-00	1-108-383-00	1-108-427-00	0.33	1-108-855-00	–	–
0.0039	1-108-354-00	1-108-372-00	1-108-416-00	0.039	1-108-360-00	1-108-384-00	1-108-428-00	0.39	1-108-856-00	–	–
0.0047	1-108-234-00	1-108-373-00	1-108-417-00	0.047	1-108-246-00	1-108-385-00	1-108-429-00	0.47	1-108-857-00	–	–
0.0056	1-108-355-00	1-108-374-00	1-108-418-00	0.056	1-108-361-00	1-108-386-00	1-108-430-00				
0.0068	1-108-237-00	1-108-375-00	1-108-419-00	0.068	1-108-249-00	1-108-387-00	1-108-431-00				
0.0082	1-108-356-00	1-108-376-00	1-108-420-00	0.082	1-108-362-00	1-108-388-00	1-108-432-00				



TANTALUM CAPACITORS

→: Use the high voltage rated one.

CAP. (μF)	RATING 3.15 VOLT. PART No.	6.3 VOLT. PART No.	10 VOLT. PART No.	16 VOLT. PART No.	20 VOLT. PART No.	25 VOLT. PART No.	35 VOLT. PART No.
0.01					→	→	1-131-396-00 Ⓑ
0.015						→	1-131-397-00 Ⓑ
0.022						→	1-131-398-00 Ⓑ
0.033						→	1-131-399-00 Ⓑ
0.047						→	1-131-400-00 Ⓑ
0.068					→	→	1-131-401-00 Ⓑ
0.1					→	→	1-131-402-00 Ⓑ
0.15					→	→	1-131-403-00 Ⓑ
0.22					→	→	1-131-404-00 Ⓑ
0.33					→	1-131-409-00 Ⓑ	1-131-405-00 Ⓑ
0.47	–	–	–	–	1-131-412-00 Ⓑ	→	1-131-406-00 Ⓑ
0.68	–	–	–	1-131-415-00 Ⓑ	→	1-131-410-00 Ⓑ	1-131-407-00 Ⓑ
1.0	–	–	1-131-418-00 Ⓑ	–	1-131-413-00 Ⓑ	→	1-131-408-00 Ⓑ
1.5	–	1-131-421-00 Ⓑ	–	1-131-416-00 Ⓑ	→	1-131-411-00 Ⓑ	1-131-348-00 Ⓑ
2.2	1-131-424-00 Ⓑ	–	1-131-419-00 Ⓑ	–	1-131-414-00 Ⓑ	1-131-355-00 Ⓑ	1-131-349-00 Ⓑ
3.3	–	1-131-422-00 Ⓑ	–	1-131-417-00 Ⓑ	1-131-362-00 Ⓑ	1-131-356-00 Ⓑ	1-131-350-00 Ⓑ
4.7	1-131-425-00 Ⓑ	–	1-131-420-00 Ⓑ	1-131-369-00 Ⓑ	1-131-363-00 Ⓑ	1-131-357-00 Ⓑ	1-131-351-00 Ⓒ
6.8	–	1-131-423-00 Ⓑ	1-131-376-00 Ⓑ	1-131-370-00 Ⓑ	1-131-364-00 Ⓑ	1-131-358-00 Ⓒ	1-131-352-00 Ⓒ
10	1-131-426-00 Ⓑ	1-131-383-00 Ⓑ	1-131-377-00 Ⓑ	1-131-371-00 Ⓑ	1-131-365-00 Ⓒ	1-131-359-00 Ⓒ	1-131-353-00 Ⓓ
15	1-131-390-00 Ⓑ	1-131-384-00 Ⓑ	1-131-378-00 Ⓑ	1-131-372-00 Ⓑ	1-131-366-00 Ⓒ	1-131-360-00 Ⓓ	–
22	1-131-391-00 Ⓑ	1-131-385-00 Ⓑ	1-131-379-00 Ⓒ	1-131-373-00 Ⓒ	1-131-367-00 Ⓓ		
33	1-131-392-00 Ⓑ	1-131-386-00 Ⓒ	1-131-380-00 Ⓒ	1-131-374-00 Ⓓ			
47	1-131-393-00 Ⓒ	1-131-387-00 Ⓒ	1-131-381-00 Ⓓ	–			
68	1-131-394-00 Ⓑ	1-131-388-00 Ⓒ	–	–			
100	1-131-395-00 Ⓓ	–	–	–			



TANTALUM CAPACITORS

CAP. (μF)	RATING 3 VOLT. PART No.	6.3 VOLT. PART No.	10 VOLT. PART No.	16 VOLT. PART No.	20 VOLT. PART No.	35 VOLT. PART No.
0.033						1-131-273-00 Ⓔ
0.047						1-131-274-00 Ⓔ
0.068						1-131-275-00 Ⓔ
0.1						1-131-276-00 Ⓓ
0.15						1-131-277-00 Ⓓ
0.22			–	–	1-131-262-00 Ⓓ	1-131-278-00 Ⓓ
0.33			–	–	1-131-263-00 Ⓓ	1-131-279-00 Ⓓ
0.47			1-131-169-00 Ⓓ	–	1-131-264-00 Ⓓ	1-131-280-00 Ⓓ
0.68			–	1-131-258-00 Ⓓ	1-131-265-00 Ⓓ	1-131-281-00 Ⓓ
1.0			1-131-254-00 Ⓓ	–	1-131-266-00 Ⓓ	1-131-282-00 Ⓓ
1.5		1-131-250-00 Ⓓ	–	–	1-131-267-00 Ⓓ	1-131-283-00 Ⓔ
2.2		–	–	1-131-259-00 Ⓓ	1-131-268-00 Ⓓ	1-131-284-00 Ⓔ
3.3		–	1-131-255-00 Ⓓ	–	1-131-269-00 Ⓓ	–
4.7		1-131-251-00 Ⓔ	1-131-171-00 Ⓓ	–	1-131-270-00 Ⓓ	–
6.8		–	–	1-131-260-00 Ⓓ	1-131-271-00 Ⓔ	–
10	–	–	1-131-256-00 Ⓓ	–	1-131-272-00 Ⓔ	–
15	–	1-131-252-00 Ⓓ	–	1-131-261-00 Ⓔ		
22	–	–	1-131-257-00 Ⓔ	–		
33	1-131-176-00 Ⓓ	1-131-253-00 Ⓔ	1-131-173-00 Ⓒ	–		
47	1-131-288-00 Ⓕ	1-131-174-00 Ⓓ	–	–		
100	1-131-177-00 Ⓓ					

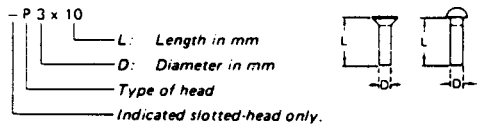
1/4 WATT CARBON RESISTORS Ⓐ

Note: Circled letter Ⓐ is applicable to European models only.

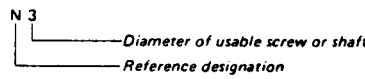
Ω	*Part No.*	Ω	*Part No.*	Ω	*Part No.*	Ω	*Part No.*	Ω	*Part No.*	Ω	*Part No.*	Ω	*Part No.*
1.0	1-246-401-00	10	1-246-425-00	100	1-246-449-00	1.0k	1-246-473-00	10k	1-246-497-00	100k	1-246-521-00	1.0M	1-246-545-00
1.1	1-246-402-00	11	1-246-426-00	110	1-246-450-00	1.1k	1-246-474-00	11k	1-246-498-00	110k	1-246-522-00	1.1M	1-210-814-00
1.2	1-246-403-00	12	1-246-427-00	120	1-246-451-00	1.2k	1-246-475-00	12k	1-246-499-00	120k	1-246-523-00	1.2M	1-210-815-00
1.3	1-246-404-00	13	1-246-428-00	130	1-246-452-00	1.3k	1-246-576-00	13k	1-246-500-00	130k	1-246-524-00	1.3M	1-210-816-00
1.5	1-246-405-00	15	1-246-429-00	150	1-246-453-00	1.5k	1-246-577-00	15k	1-246-501-00	150k	1-246-525-00	1.5M	1-210-817-00
1.6	1-246-406-00	16	1-246-430-00	160	1-246-454-00	1.6k	1-246-578-00	16k	1-246-502-00	160k	1-246-526-00	1.6M	1-210-818-00
1.8	1-246-407-00	18	1-246-431-00	180	1-246-455-00	1.8k	1-246-579-00	18k	1-246-503-00	180k	1-246-527-00	1.8M	1-210-819-00
2.0	1-246-408-00	20	1-246-432-00	200	1-246-456-00	2.0k	1-246-580-00	20k	1-246-504-00	200k	1-246-528-00	2.0M	1-210-820-00
2.2	1-246-409-00	22	1-246-433-00	220	1-246-457-00	2.2k	1-246-581-00	22k	1-246-505-00	220k	1-246-529-00	2.2M	1-210-821-00
2.4	1-246-410-00	24	1-246-434-00	240	1-246-458-00	2.4k	1-246-582-00	24k	1-246-506-00	240k	1-246-530-00	2.4M	1-244-754-00
2.7	1-246-411-00	27	1-246-435-00	270	1-246-459-00	2.7k	1-246-583-00	27k	1-246-507-00	270k	1-246-531-00	2.7M	1-244-755-00
3.0	1-246-412-00	30	1-246-436-00	300	1-246-460-00	3.0k	1-246-584-00	30k	1-246-508-00	300k	1-246-532-00	3.0M	1-244-756-00
3.3	1-246-413-00	33	1-246-437-00	330	1-246-461-00	3.3k	1-246-585-00	33k	1-246-509-00	330k	1-246-533-00	3.3M	1-244-757-00
3.6	1-246-414-00	36	1-246-438-00	360	1-246-462-00	3.6k	1-246-586-00	36k	1-246-510-00	360k	1-246-534-00	3.6M	1-244-758-00
3.9	1-246-415-00	39	1-246-439-00	390	1-246-463-00	3.9k	1-246-587-00	39k	1-246-511-00	390k	1-246-535-00	3.9M	1-244-759-00
4.3	1-246-416-00	43	1-246-440-00	430	1-246-464-00	4.3k	1-246-488-00	43k	1-246-512-00	430k	1-246-536-00	4.3M	1-244-760-00
4.7	1-246-417-00	47	1-246-441-00	470	1-246-465-00	4.7k	1-246-489-00	47k	1-246-513-00	470k	1-246-537-00	4.7M	1-244-761-00
5.1	1-246-418-00	51	1-246-442-00	510	1-246-466-00	5.1k	1-246-490-00	51k	1-246-514-00	510k	1-246-538-00	5.1M	1-244-762-00
5.6	1-246-419-00	56	1-246-443-00	560	1-246-467-00	5.6k	1-246-491-00	56k	1-246-515-00	560k	1-246-539-00		
6.2	1-246-420-00	62	1-246-444-00	620	1-246-468-00	6.2k	1-246-492-00	62k	1-246-516-00	620k	1-246-540-00		
6.8	1-246-421-00	68	1-246-445-00	680	1-246-469-00	6.8k	1-246-493-00	68k	1-246-517-00	680k	1-246-541-00		
7.5	1-246-422-00	75	1-246-446-00	750	1-246-470-00	7.5k	1-246-494-00	75k	1-246-518-00	750k	1-246-542-00		
8.2	1-246-423-00	82	1-246-447-00	820	1-246-471-00	8.2k	1-246-495-00	82k	1-246-519-00	820k	1-246-543-00		
9.1	1-246-424-00	91	1-246-448-00	910	1-246-472-00	9.1k	1-246-496-00	91k	1-246-520-00	910k	1-246-544-00		

HARDWARE NOMENCLATURE

Screw:



Nut, Washer, Retaining ring:



Reference Designation	Shape	Description	Remarks
		SCREWS	
P		pan-head screw	binding-head (B) screw for replacement
PWH		pan-head screw with washer face	binding-head (B) screw and flat washer for replacement
PS PSP		pan-head screw with spring washer	binding-head (B) screw and spring washer for replacement
PSW PSPW		pan-head screw with spring and flat washers	binding-head (B) screw and spring and flat washers for replacement
R		round-head screw	binding-head (B) screw for replacement
K		flat-countersunk-head screw	
RK		oval-countersunk-head screw	
B		binding-head screw	
T		truss-head screw	binding-head (B) screw for replacement
F		flat-fillister-head screw	
RF		fillister-head screw	
BV		braizer-head screw	

Reference Designation	Shape	Description	Remarks
		SELF-TAPPING SCREWS	
TA		self-tapping screw	ex: TA, P 3 x 10
PTP		pan-head self-tapping screw	binding-head self-tapping (TA, B) screw for replacement
PTPWH		pan-head self-tapping screw with washer face	binding-head self tapping (TA, B) screw and flat washer for replacement
PTTWH	Ⓐ	pan-head thread-rolling screw with washer face	binding-head (B) screw and flat washer for replacement
		SET SCREWS	
SC		set screw	
SC		hexagon-socket set screw	ex: SC 2.6 x 4, hexagon socket
		NUT	
N		nut	
		WASHERS	
W		flat washer	
SW		spring washer	
LW		internal-tooth lock washer	ex: LW3, internal
LW		external-tooth lock washer	ex: LW3, external
		RETAINING RINGS	
E		retaining ring	
G		grip-type retaining ring	

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